

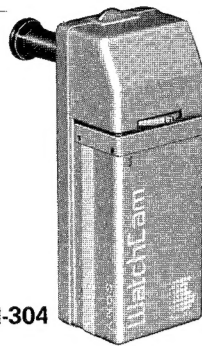
HNS-16A FDM-404A HVM-304

SERVICE MANUAL

AEP Model

April, 1986

HVM-304



FDM-404A

WatchCam

V436

SPECIFICATIONS

HVM-304 black-and-white video camera

Image pickup tube 1/2-inch B/W SATICON™ tube

Signal system CCIR standards

Scanning system 625 lines, 2:1 interlace

Frame 25 frames/sec.

Sync system Internal

Scanning frequency

Horizontal 15.625 kHz

Vertical 50 Hz

Lens f = 11 mm, F1.8, fixed focus, auto-iris

Automatic controls

Auto-gain and auto-beam control

Minimum illumination

5 lux (10 lux when the camera mount and fish-eye lens are incorporated)

Output 4P MULTI connector

① DC input ② Video output

③ Ground ④ Audio output

Video, 1.0V p-p, 75 ohms, sync negative

Audio, -5dBs (436 mVrms)

less than 10 kilohms

Power, 5.1 through 15V DC, 6V DC normal

Input

Microphone Built-in electret condenser type

Power consumption

Approx. 0.9W when the auto-iris is opened

Dimensions Approx. 52 × 32 × 100 mm (w/h/d)
(2 1/8 × 1 5/16 × 3 15/16 inches)

Weight Approx. 170g (6 oz)

Camera mount

View angle

Approx. 150 degrees (diagonally)

Door lens

Lens structure, 4 groups 5 elements

Afocal system

Relay lens

Lens structure, 8 groups 8 elements

Afocal magnification × 0.58 with special bayonet mount

FDM-404A flat black-and-white monitor

TV system

CCIR standards

Picture tube

Flat black-and-white

4-inch (10 cm) picture measured diagonally

Speaker

Approx. 3.6 cm (1.5 inches) dia.

Audio output

0.05W (7.2 ohms)

Input

4P MULTI connector

① 6V DC output ② Video input:

1.0V p-p, 75 ohms, sync negative

③ Ground ④ Audio input:

-5 dBs (436 mVrms) more than 30 kilohms

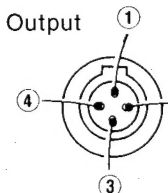
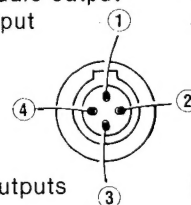
Earphone jack (minijack)

AV OUT (AV uniconnector)

Video output: 1.0 Vp-p, 75 ohms, sync negative

Audio output: -5 dBs (436 mVrms), less than 10 kilohms

Outputs



ACC

CAMERA AND MONITOR SYSTEM
SONY®

Power requirements

6 V DC
DC IN 6V jack accepts: supplied
AC power adaptor for use on
220 V AC, 50 Hz or optional DCC-40A
car battery cord for use on 12V

Power consumption

Approx. 3.3W

Dimensions Approx. 110 × 210 × 46 mm (w/h/d)
(4³/₈ × 8³/₈ × 1¹³/₁₆ inches)

Weight Approx. 720 g (1 lb 9 oz)

AC-40E AC power adaptor

Input 220 V AC, 50 Hz

Output 6V DC, 700mA

Dimensions 66 × 59 × 117 mm (w/h/d)
(2⁵/₈ × 2³/₈ × 4⁵/₈ inches)

Cord length 2.25 m (7 feet 4 inches)
(with AC power plug)

2 m (6 feet 8 inches)
(with DC plug)

Optional accessories

Camera extension cable VK-110
(10 m, 33 feet)

Camera cable VK-120A (20 m,
66 feet)

Plug adaptor VMC-140

Audio/video connecting cable VMC-
612MS (2 m, 6 feet 8 inches)

Car battery cord DCC-40A

Earphone

Wide attachment lens VCL-06HS

Tripod attachment VCT-01

Design and specifications are subject to change without notice.

SAFETY-RELATED COMPONENT WARNING !!


COMPONENTS IDENTIFIED BY SHADING AND MARK  ON THE SCHEMATIC DIAGRAMS, EXPLODED VIEWS AND IN THE PARTS LIST ARE CRITICAL TO SAFE OPERATION. REPLACE THESE COMPONENTS WITH SONY PARTS WHOSE PART NUMBERS APPEAR AS SHOWN IN THIS MANUAL OR IN SUPPLEMENTS PUBLISHED BY SONY. CIRCUIT ADJUSTMENTS THAT ARE CRITICAL TO SAFE OPERATION ARE IDENTIFIED IN THIS MANUAL. FOLLOW THESE PROCEDURES WHENEVER CRITICAL COMPONENTS ARE REPLACED OR IMPROPER OPERATION IS SUSPECTED.

TABLE OF CONTENTS

<u>Section</u>	<u>Title</u>	<u>Page</u>	<u>Section</u>	<u>Title</u>	<u>Page</u>
1. GENERAL			4. EXPLODED VIEW		35
1-1.	Features	3	5. ELECTRICAL PARTS LIST		36
1-2.	Your Kit Includes	4			
1-3.	Versatile Use of The System	5	HVM-304		
1-4.	Installing the Camera Unit	6	1. DISASSEMBLY AND REPLACEMENT		
1-5.	Monitor Placement	10	1-1.	Case Removal	42
1-6.	System Connection	11	1-2.	PCB Assembly and Shield Case Removal	43
1-7.	Operation	12	1-3.	Pickup Tube and Lens Block Assembly Removal	43
1-8.	Picture Adjustment	12	2. ADJUSTMENTS		
1-9.	Troubleshooting	12	2-1.	Setup Adjustments	44
1-10.	Other Controls and Jacks of the Monitor	13	2-2.	Circuit Adjustments	44
			2-2-1.	SR Board Adjustments	45
			2-2-2.	PW Board Adjustments	45
FDM-404			3. DIAGRAMS		
1. DISASSEMBLY AND REPLACEMENT			3-1.	Block Diagram	46
1-1.	Case (Upper) Removal	16	3-2.	Circuit Boards Location	47
1-2.	Picture Tube Removal	17	3-3.	Schematic Diagram	48
1-3.	B Block Removal	17	3-4.	Printed Wiring Boards	
2. ADJUSTMENTS				PR and PW Boards	51
2-1.	Setup Adjustments	18		SR and DF Boards	53
2-2.	Circuit Adjustments	18	3-5.	Semiconductors	52
2-2-1.	B Board Adjustments	19	4. EXPLODED VIEWS		
2-2-2.	D Board Adjustments	21	4-1.	Camera and Camera Bracket	54
2-2-3.	G Board Adjustments	23	4-2.	Door Adaptor	55
2-2-4.	Hold Down Circuit Adjustments	24	5. ELECTRICAL PARTS LIST		56
3. DIAGRAMS					
3-1.	Circuit Boards Location	25			
3-2.	Block Diagram	26			
3-3.	Schematic Diagram	28			
3-4.	Printed Wiring Boards				
	D, G and V Boards	31			
	B and X Boards	33			
3-5.	Semiconductors	34			

SECTION 1 GENERAL

1-1. FEATURES

Your portable, compact, easy-to-install camera and monitor system will play an important security role as a doorkeeper at the front door or a baby-sitter in the playroom. System connection and installation are well-designed and simple. Just follow the instructions in this manual.

Besides its surveillance capability, this system has a wide range of uses possible by adding optional units.

Black-and-white video camera...HVM-304

- Truly compact and light-weight
- Less gain loss and lower power consumption
- SATICON™ B/W half-inch tube is incorporated.
- Auto-iris, auto-gain and auto-beam control assures steady shooting and clear pictures.
- Equipped with 4-pin connector for video and audio outputs
- Quick-start when the POWER switch of the monitor is pressed

- Built-in electret condenser microphone
- Supplied camera cable (20 m, 66 feet) can be extended up to 60 m (198 feet) by using 4 optional VK-110 camera extension cables (10 m, 33 feet each).

Flat black-and-white monitor...FDM-404A

- Miniature B/W monitor for portable or desktop use
- 4-inch flat black-and-white picture tube
- Recessed tilted screen for comfortable viewing
- Built-in 1.5-inch speaker
- DYNAMIC FOCUS increases sharpness over the entire screen
- DC IN 6V jack for connecting to the AC power adaptor
- Equipped with 4-pin connector for 6V DC output and video and audio inputs
- AV unconnector for audio and video output to connect another FDM-404A monitor (optional) for multi-monitor system.

1-2. YOUR KIT INCLUDES

- ① Stand for the monitor
- ②③ Camera holder (L-shape wrench and screws supplied) to position the camera near the subject to be watched
- ④ Bracket
- ⑤ Camera (HVM-304)
- ⑥ Camera mount with fish-eye lens and camera mount chassis
- ⑦⑧ Wall plate (screws supplied) to hang the monitor on the wall
- ⑧ Monitor (FDM-404A)
- ⑩ Scale to measure door thickness (packed separately, in the vinyl bag of the instruction manual)
- ⑪ Cable (20 m, 66 feet) to connect camera and monitor
- ⑫ Camera hood to be used when the camera is on the camera holder
- ⑬ AC power adaptor (AC-40E) to supply the power to the monitor and camera
- ⑭ AC plug adaptor (attached to the AC power cord plug)
- ⑮ Adhesive-backed cable clips
- ⑯ Spacer
- ⑰ Frame
- ⑱ Camera mount chassis

Other tool or parts required for installations:

Masking tape

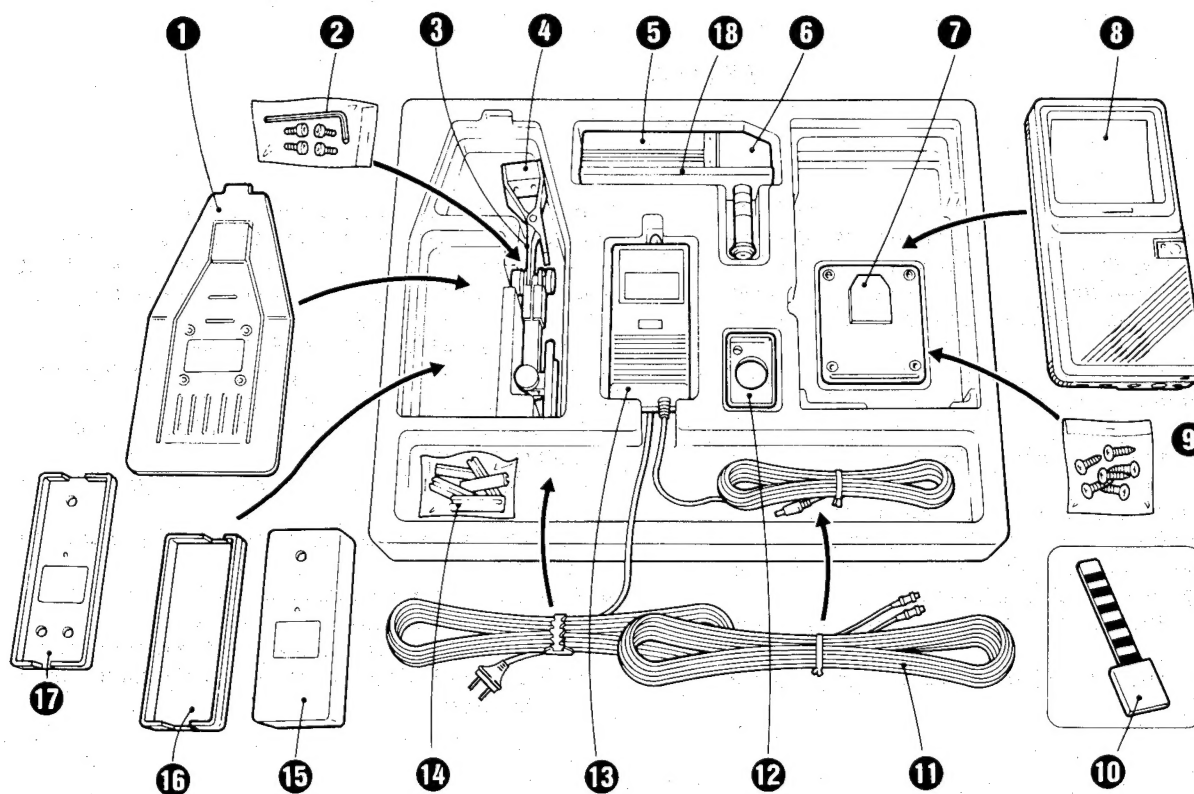
Phillips head screwdriver (6 mm dia.)

Screws (P4 × 20, P4 × 25)

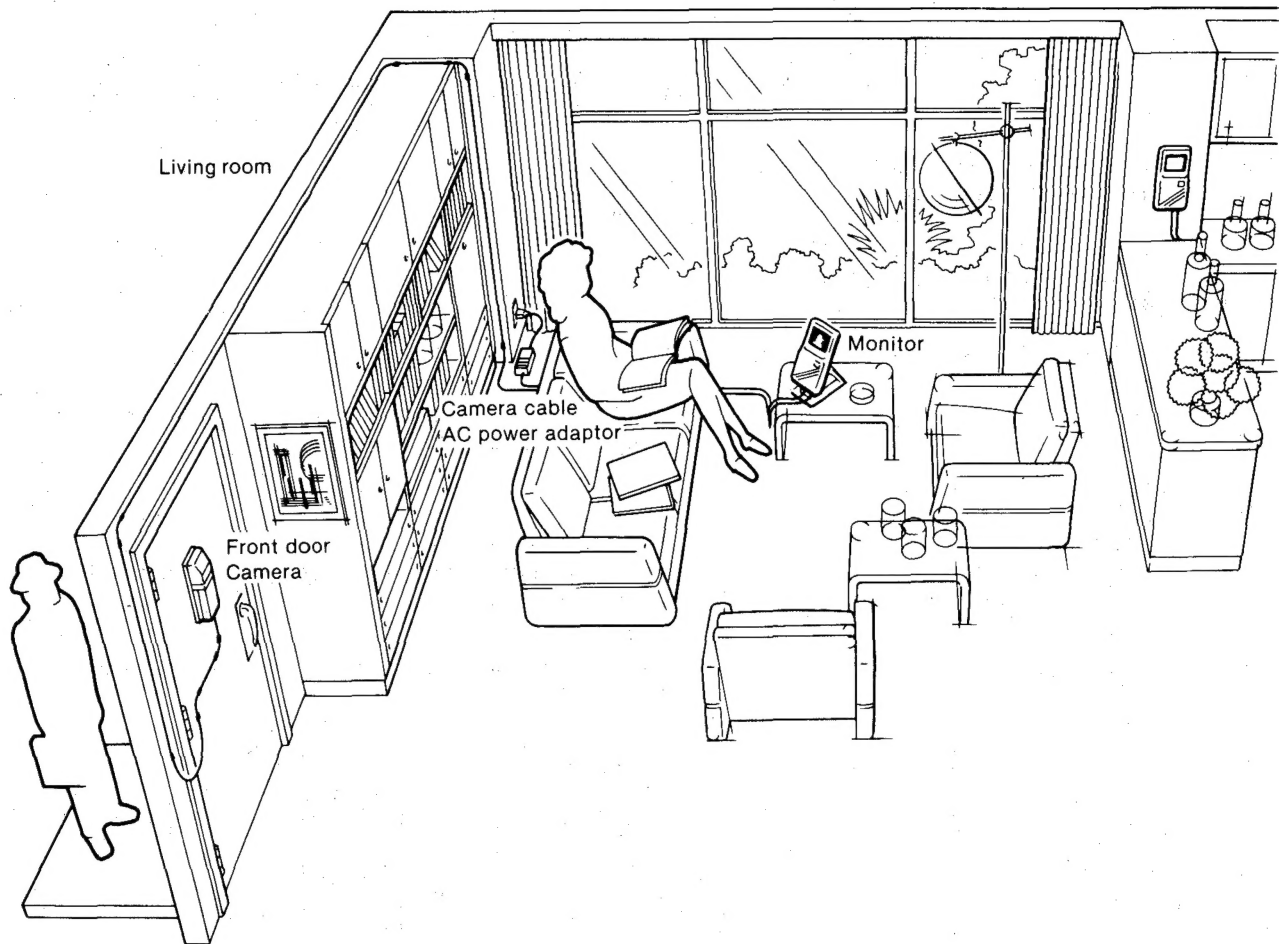
MODEL NUMBER OR PART NUMBER LIST

Refer them whenever you call upon Sony service facility.

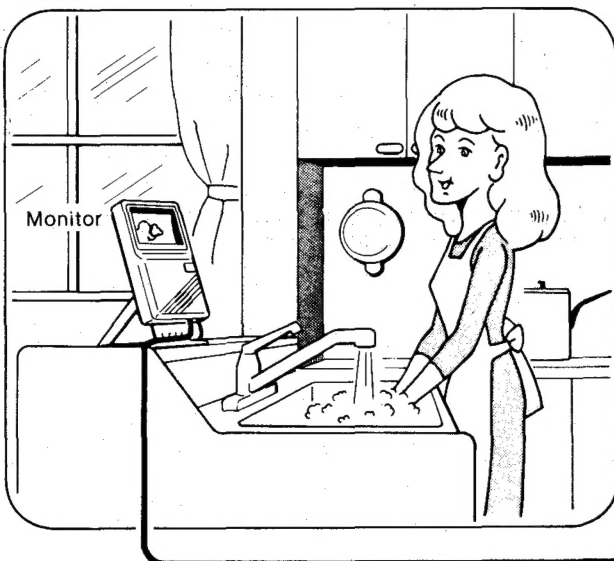
No.	Part	Model number
①	Stand	
②	Screws	
②	L-shape wrench	
③	Camera holder	
④	Bracket	
⑤	Camera	HVM-304
⑥	Camera mount	
⑦	Wall plate	
⑧	Monitor	FDM-404A
⑨	Screws for wall	
⑩	Scale	
⑪	Cable	
⑫	Camera hood	
⑬	AC power adaptor	AC-40E
⑭	Cable clips	
⑮	Spacer	
⑯	Frame	
⑰	Camera mount chassis	



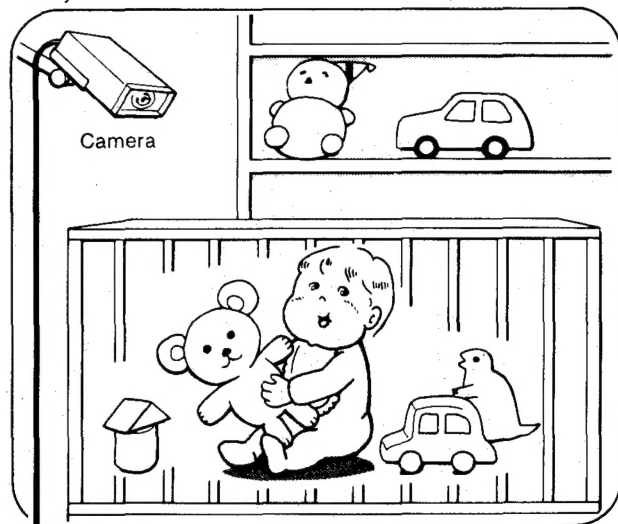
1-3. VERSATILE USE OF THE SYSTEM FOR SURVEILLANCE



Kitchen



Playroom



See page 9.

1-4. INSTALLING THE CAMERA UNIT

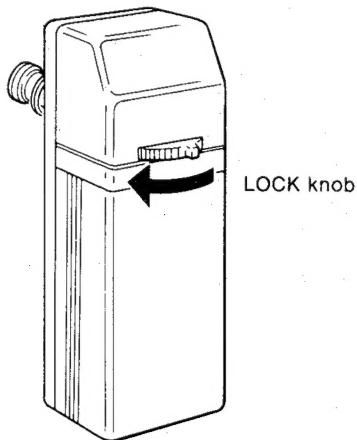
ON THE DOOR

PREPARATIONS

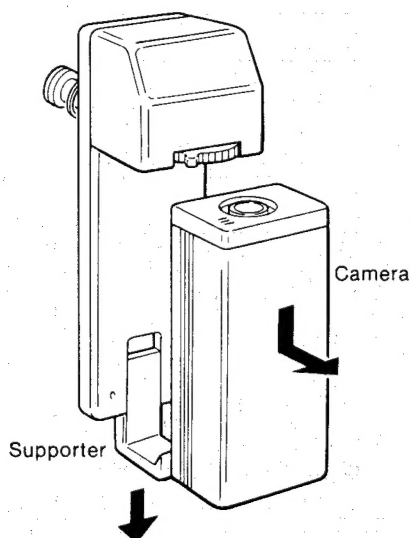
- 1 Remove the fish-eye lens installed in your front door. Use a countersunk head screwdriver or similar object to remove the lens easily.
- 2 Clean the hole to remove any dust or dirt as it might damage the camera mount lens or the fish-eye lens.

Make sure the hole in the door is large enough for the fish-eye lens of the camera mount. If the hole is too small, use a drill or other tool to enlarge it.

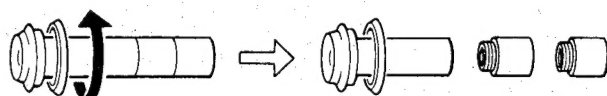
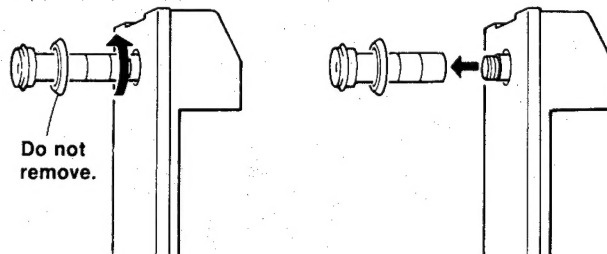
- 3 Slide the LOCK knob of the camera mount to the left to release the camera.



- 4 Slide the camera down, and lift it out of the supporter.



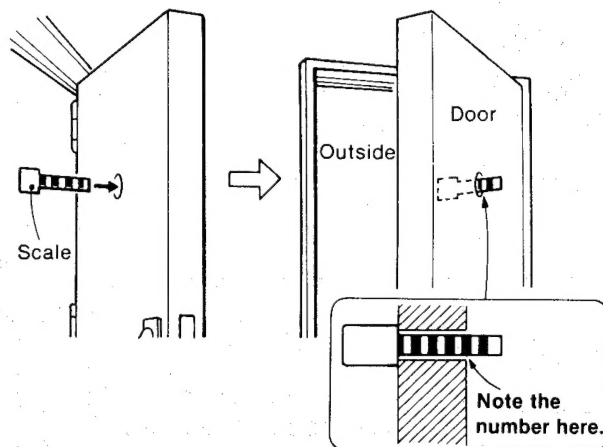
- 5 Remove the fish-eye lens from the camera mount by turning it counterclockwise.



Caution

If the lens surface becomes dusty or dirty, picture quality will suffer.

- 6 Using the supplied scale, measure the thickness of the door.

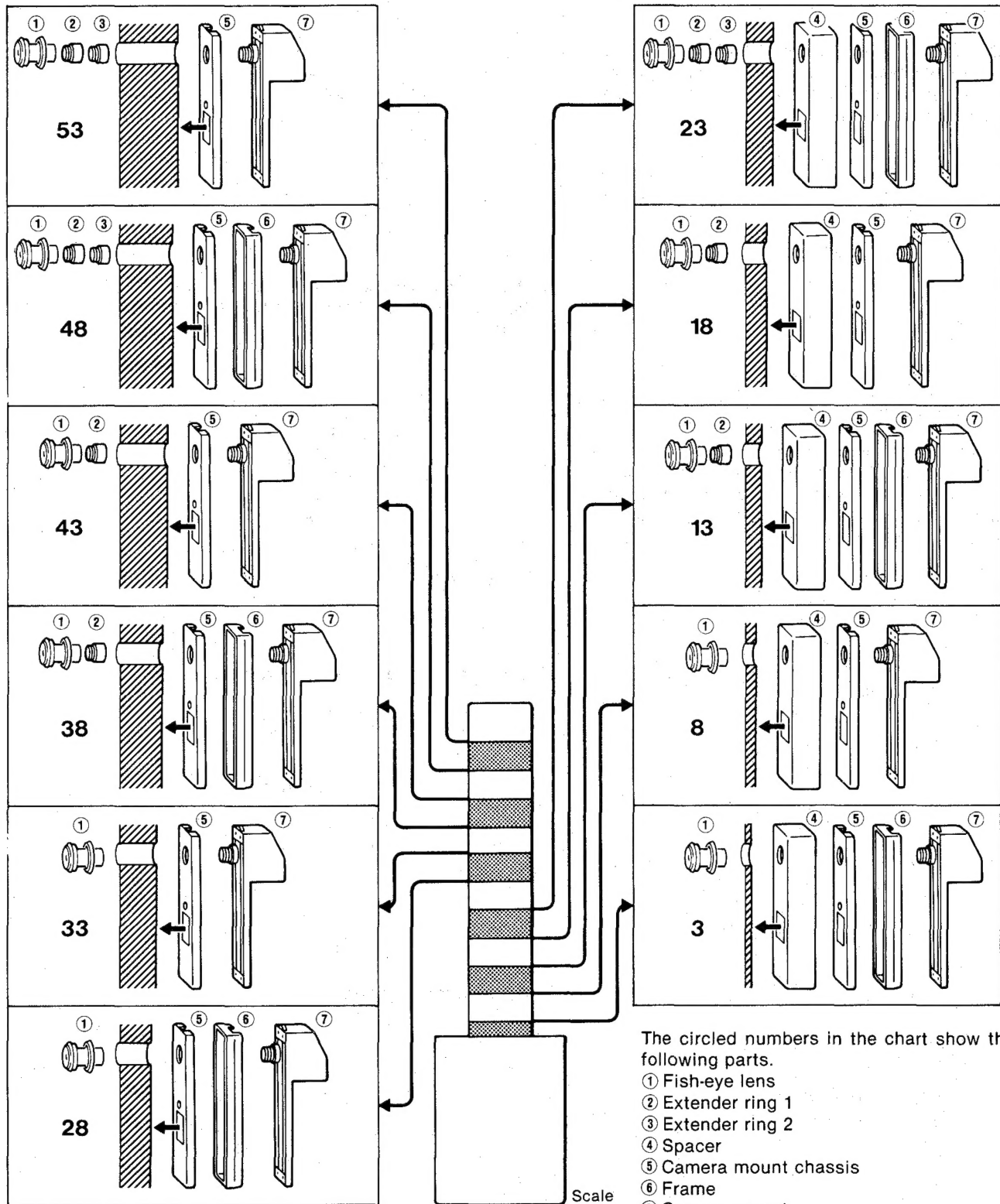


- 7 Select the parts necessary as indicated in the chart on next page according to the number.

QUICK REFERENCE CHART FOR PARTS TO BE USED

Affix the camera mount chassis to inside of the door first. (For scale numbers 28 to 53)

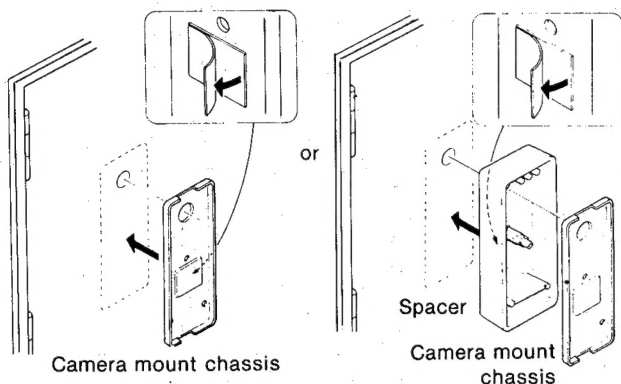
Affix the spacer to inside of the door first. (For scale numbers 3 to 23)



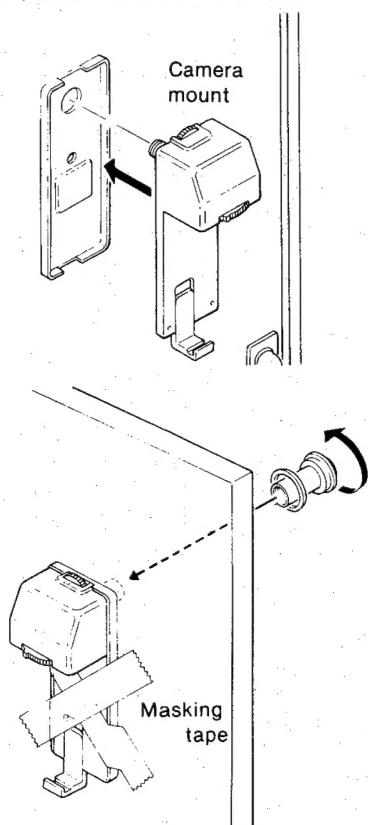
INSTALLATION

Referring to the quick reference chart for parts to be used on page 7 which matches the thickness of your door, install the unit following these 7 steps.

- 1 Peel the cover off the adhesive pad and position the camera mount chassis or the spacer on the inside of the door, carefully aligning the door hole and the hole of the chassis or spacer.

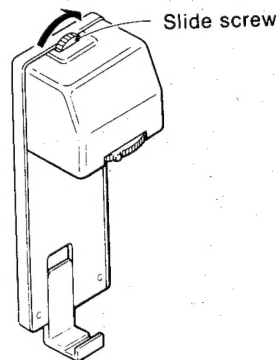


- 2 Insert the lens projection of the camera mount into the door hole and hold the camera mount in place with masking tape. Insert the frame between the camera mount chassis and the camera mount, if necessary (see the previous page).

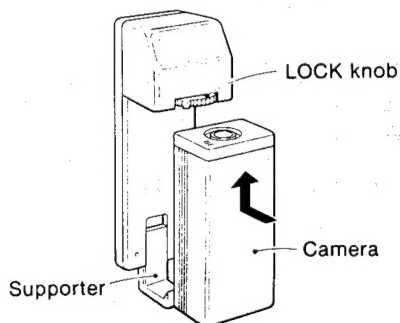


- 3 Screw the fish-eye lens and the extender ring, if necessary, from the outside of the door onto the lens projection of the camera mount.

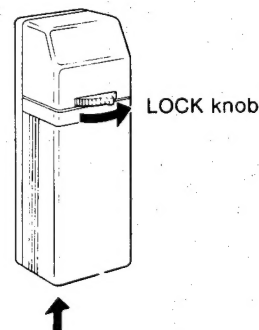
- 4 To firmly fix the camera mount to the door, turn the slide screw to the right.



- 5 Replace the camera on the camera mount. Be sure the LOCK knob is in the released position first.



- 6 Turn the knob to LOCK to secure the camera.

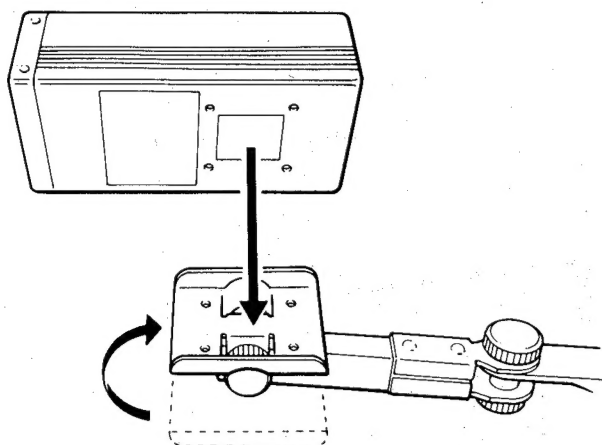


- 7 Push up the supporter.

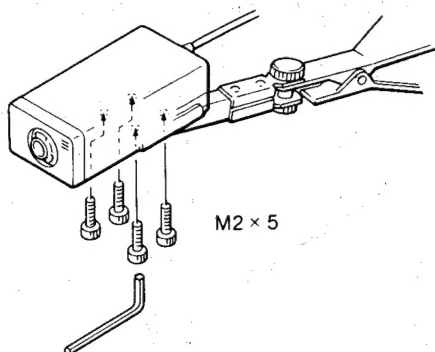
IN A ROOM

The supplied camera holder allows placement of the camera almost anywhere.

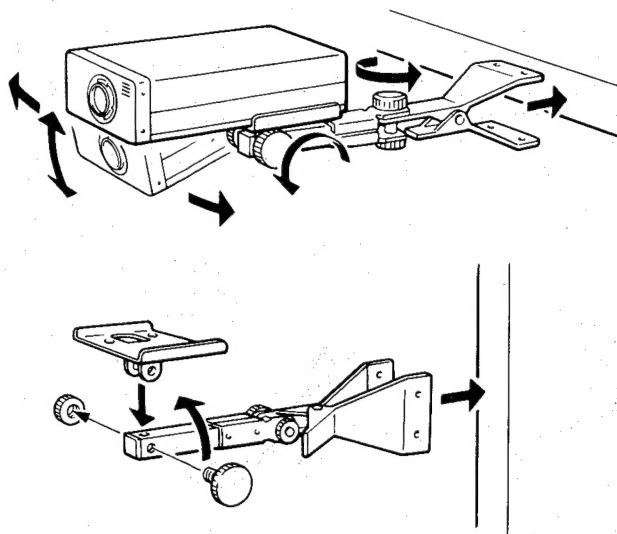
- 1 Loosen the screw of the holder plate and swing the plate around so that it is on top of the holder. Tighten the screw to hold the plate in place.



- 2 Align the 4 holes on the bottom of the camera and on the camera holder.
- 3 Using the supplied L-shape wrench and screws (in the vinyl bag of the camera holder), secure the camera to the camera holder.

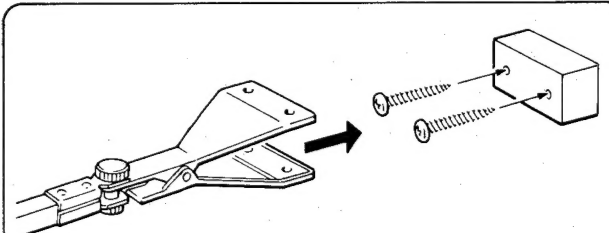
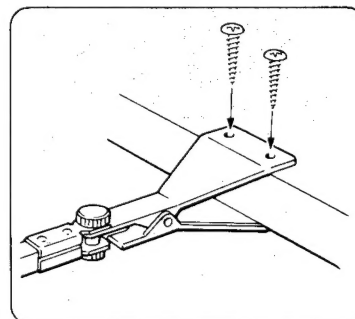


- 4 Clamp the camera holder at the desired location.



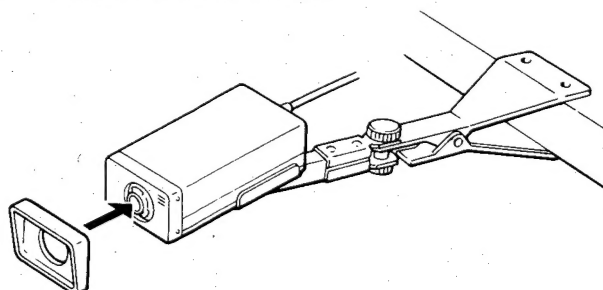
The orientation of the camera holder plate can be easily changed by unscrewing the knobs of the hinges and switching the position of the plate.

Secure the clamp with the appropriate screws (P4 x 20, not supplied), as illustrated, if necessary.



If there is nothing to clamp the camera holder, install the supplied bracket using the appropriate screws (P4 x 25, not supplied).

- 5 Attach the camera hood.

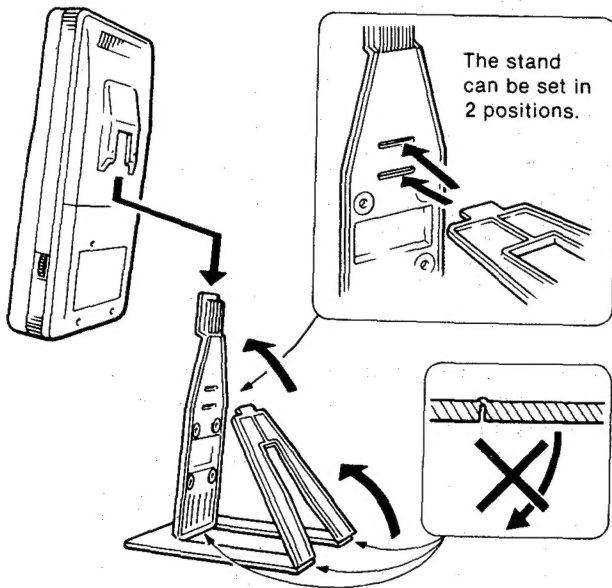


1-5. MONITOR PLACEMENT

ON THE STAND

Caution

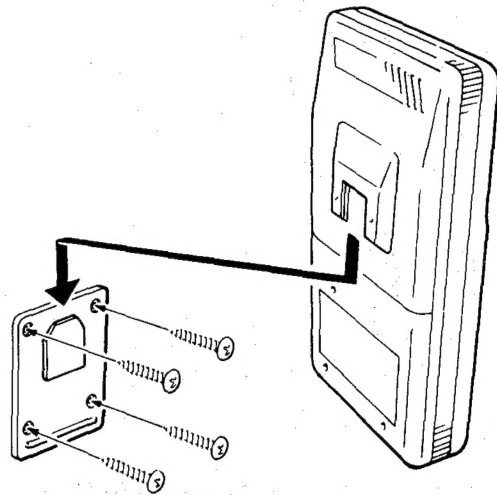
Do not bend the flaps or folded parts forcibly. If you bend them in the wrong direction, the stand may break.



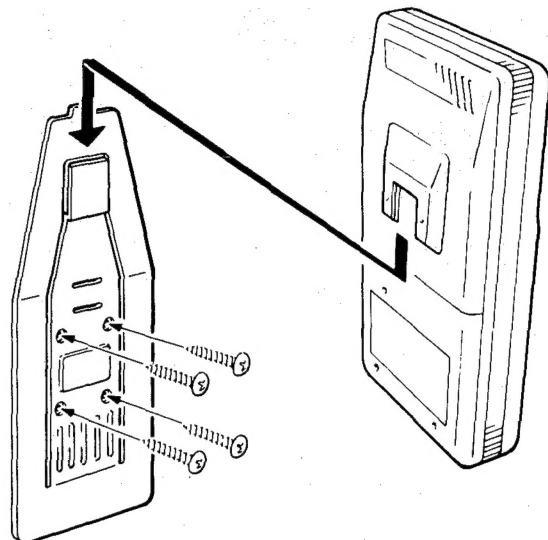
ON THE WALL

Parts and tool required:

- a** Wall plate
- b** Screws in the vinyl bag of the wall plate P4 × 16
- c** Phillips head screwdriver (6 mm dia.)



- The stand can also be attached on the wall using the same screws above.
- If the wall is masonry, use suitable masonry screws.

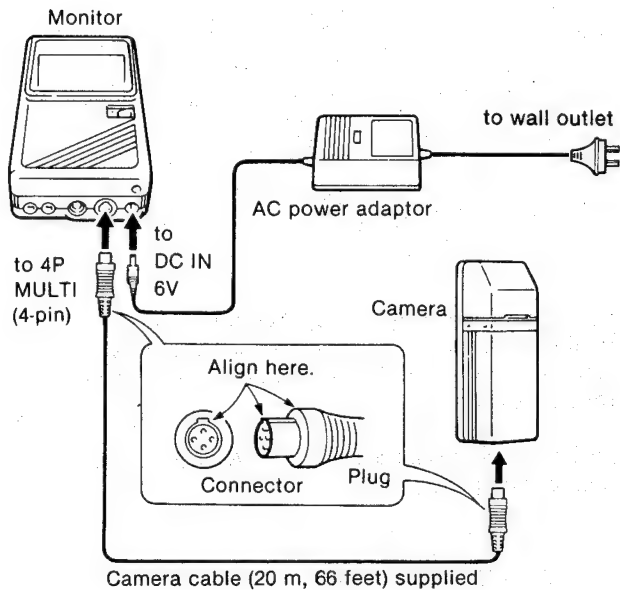


1-6. SYSTEM CONNECTION

CONNECTION DIAGRAM

Notes

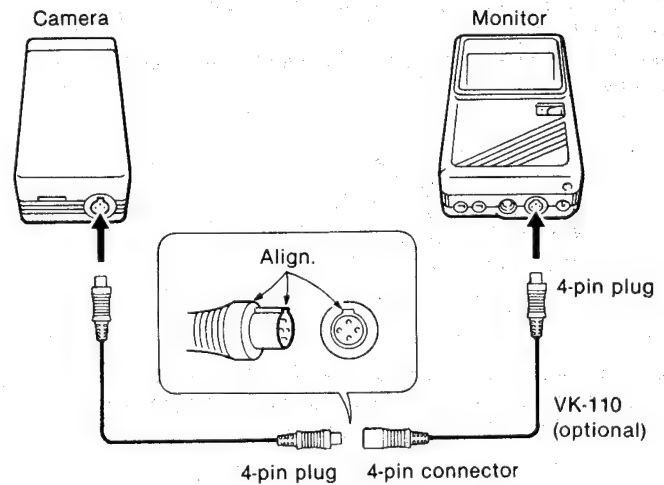
- The plugs should be fully inserted into the connectors or jacks. A loose connection may cause the system to malfunction.
- The connection to the wall outlet should be done last.



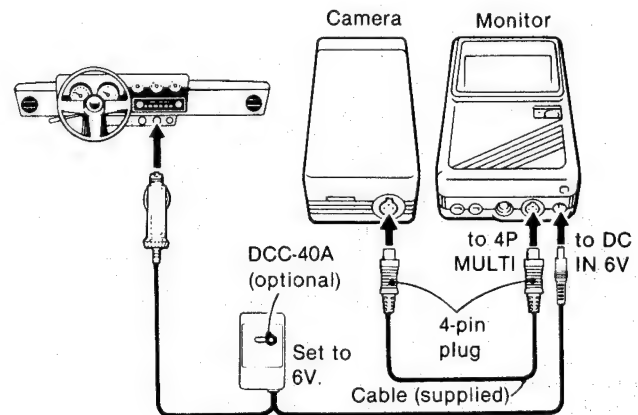
- If the plug of the power cord of the ac power adaptor does not match the wall outlet, use the supplied AC plug adaptor.

Extending the cable

The optional VK-110 camera extension cable (10 m, 33 feet) is used to extend the distance between the black-and-white camera and flat black-and-white monitor. Extendable up to 60 m (198 feet) using four VK-110.



To use with a DCC-40A car battery cord (optional)

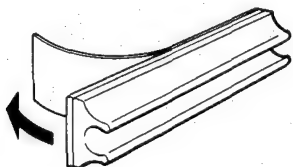


SECURING THE CABLE

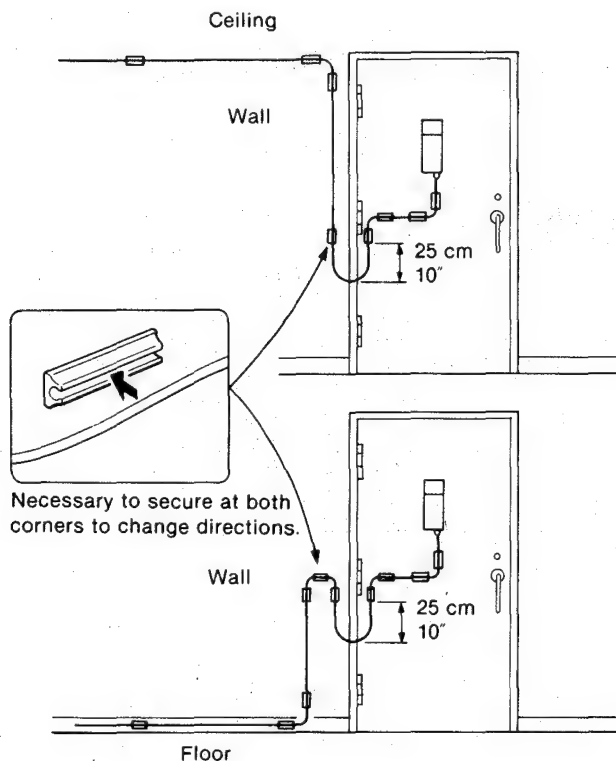
Note

The adhesive on the cable clips will only stick to smooth surfaces.

- 1 Peel the cover off the adhesive backing to affix the supplied cable clips near the door hinges and along the walls or floors. Position the clips so that the cable will be kept out of the way.

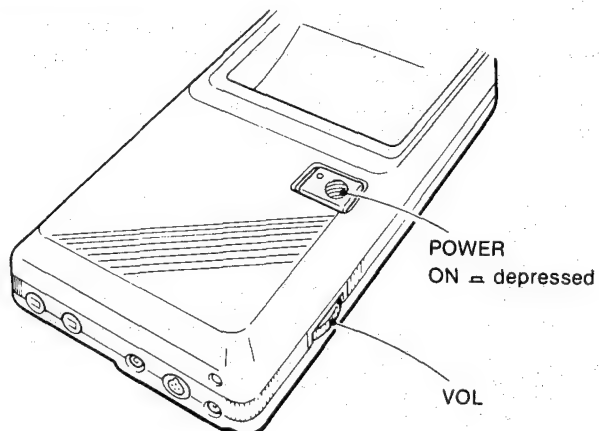


- 2 Press the cable into the clips. To assure that the door opens smoothly having enough slack in the cable (approx. 25 cm, 10 inches) as illustrated.



1-7. OPERATION

When the door bell rings, **just press the POWER switch of the monitor.**

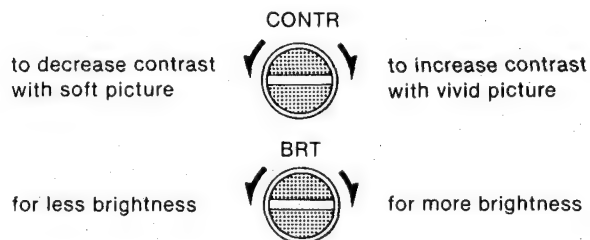


You can easily identify who is at the door by looking at the monitor. Sounds at the door may be heard (depending upon the thickness of the door) by adjusting the VOL control on the monitor.

For continuous surveillance, keep the POWER switch of the monitor depressed.

1-8. PICTURE ADJUSTMENT

at the bottom of the monitor

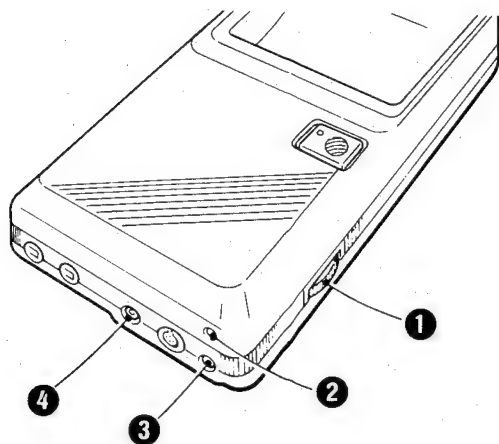


1-9. TROUBLESHOOTING

Disturbances in picture can often be eliminated by checking the symptoms and following the suggestions listed below.

SYMPTOM	CHECK AND ADJUST
The picture does not appear	<ul style="list-style-type: none"> ● Check that the connection between each piece of the system is correct and firm. ● Is POWER of the monitor switched on?
Picture reversed between left and right	<ul style="list-style-type: none"> ● Is the supporter of the camera mount set upward?

1-10. OTHER CONTROLS AND JACKS OF THE MONITOR



① VOL control

Turn this knob downward to increase the volume of the sound through the monitor speaker or the earphone.

To turn off the sound, turn it upward until it clicks. The sound of the camera microphone is heard.

② (earphone) jack (minijack)

For listening through an earphone (optional). The sound is monaural even when a mini-type stereo plug of stereo earphone is connected. When an earphone is connected, the speaker is disconnected.

③ DC IN 6V jack

Accepts the power (DC 6V) through the supplied AC power adaptor or the connected DCC-40A car battery cord (optional).

④ AV OUT connector (AV uniconnector)

To monitor the same picture and sound on another FDM-404A, connect to the 4P MULTI connector of the other FDM-404A using the optional VK-120A camera cable and VMC-140 plug adaptor.

To record the picture and sound being monitored onto a VCR, or to view the same picture and listen to the same sound on another video monitor, connect to the video input and audio input of that equipment using the optional VMC-612MS audio/video connecting cable.

FDM-404A

SERVICE MANUAL

AEP Model



April, 1986

SPECIFICATIONS

FDM-404A flat black-and-white monitor

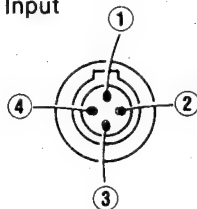
TV system

Picture tube

Speaker

Audio output

Input



Outputs

CCIR standards

Flat black-and-white

4-inch (10 cm) picture measured diagonally

Approx. 3.6 cm (1.5 inches) dia.

0.05W (7.2 ohms)

4P MULTI connector:

① 6V DC output, ② Video input, 1.0V p-p, 75 ohms, sync negative, ③ Ground, ④ Audio input: -5 dBs (436 mVrms) more than 30 kilohms

Earphone jack (minijack)

AV OUT (AV unconnector)

Video output: 1.0V p-p, 75 ohms, sync negative

Audio output: -5dBs (436 mVrms), more than 10 kilohms

Power requirements

6 V DC

DC IN 6V jack accepts: supplied AC power adaptor for use on 220V AC, 50 Hz or optional DCC-40A car battery cord for use on 12V

Power consumption

Approx. 3.3W

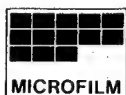
Dimensions

Approx. 110 × 210 × 46 mm (w/h/d)
(4 3/8 × 8 3/8 × 1 13/16 inches)

Weight

Approx. 720 g (1 lb 9 oz)

Design and specifications are subject to change without notice.



FLAT BLACK AND WHITE MONITOR
SONY®

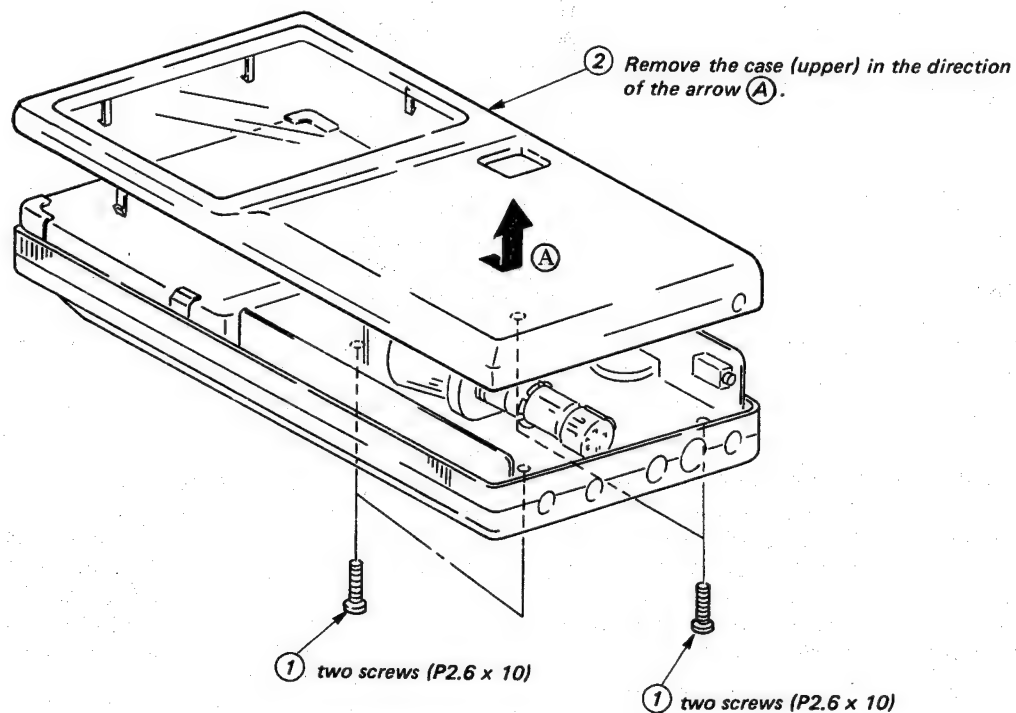
MON

SECTION 1 DISASSEMBLY AND REPLACEMENT

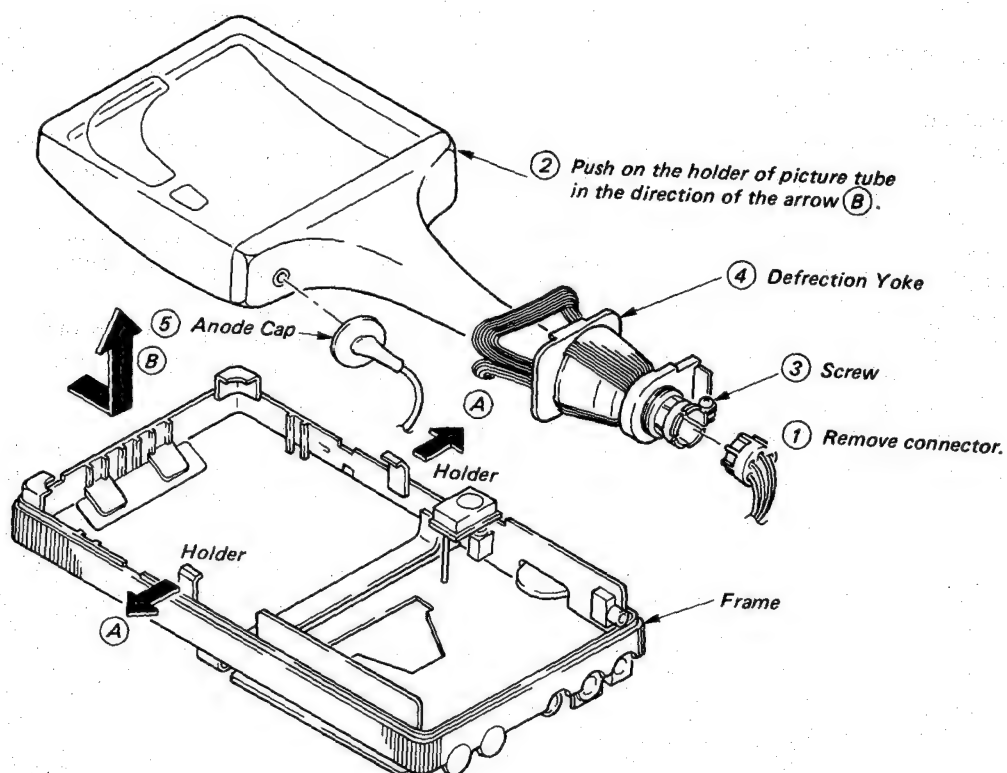
Note: Follow the disassembly procedure in the numerical order given.

1-1. CASE (UPPER) REMOVAL

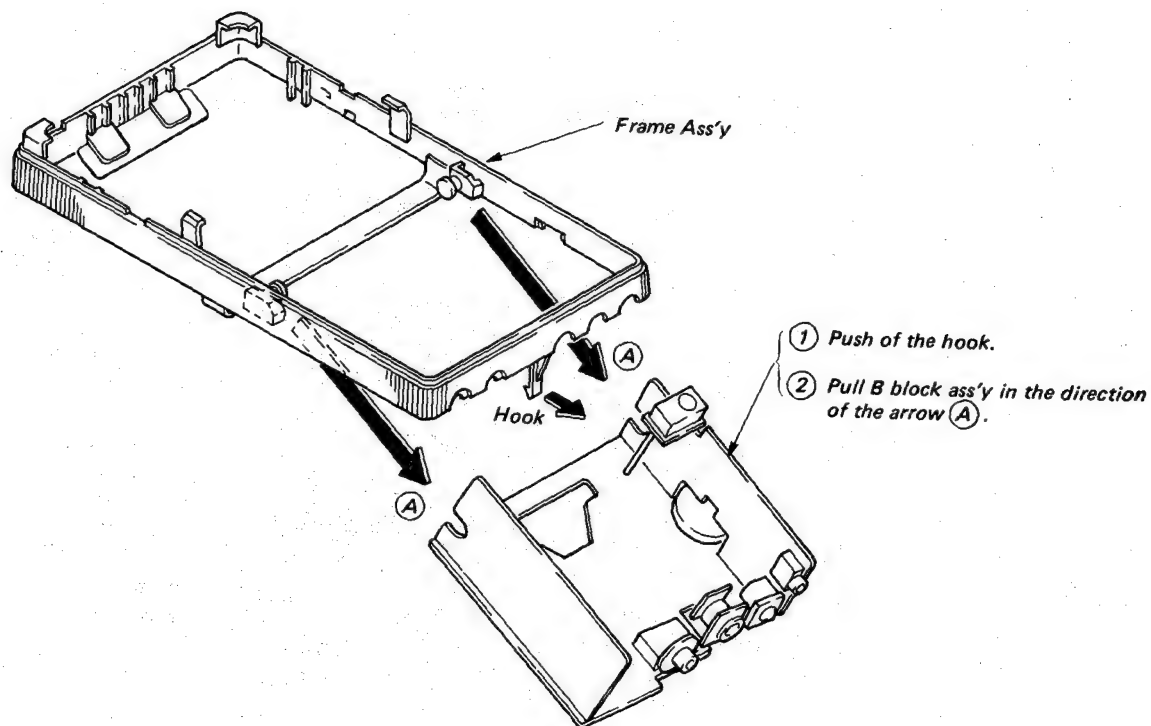
- 1) Four screws (P2.6 x 10) ①.
- 2) Remove the case (upper) 2 in the direction of the arrow ②.



1-2. PICTURE TUBE REMOVAL



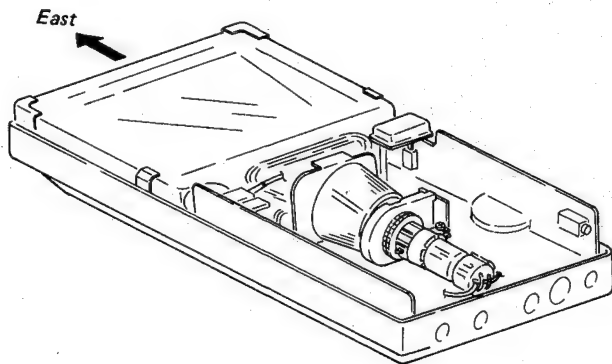
1-3. B BLOCK REMOVAL



SECTION 2 ADJUSTMENTS

2-1. SETUP ADJUSTMENTS

- 1) Required measuring instruments
 - Digital multimeter
(Internal impedance: 100MΩ)
 - Color bar/pattern generator
 - DC stabilizing power supply
 - Frequency counter
- 2) Input signal
Receive a picture from the camera or a monoscope signal from the video input.
- 3) Notes in adjustment
 - Unless otherwise specified, the adjustment should be made using a 6V DC input.
 - Adjustment and checking of the screen must be made with the camera level and its top facing east.



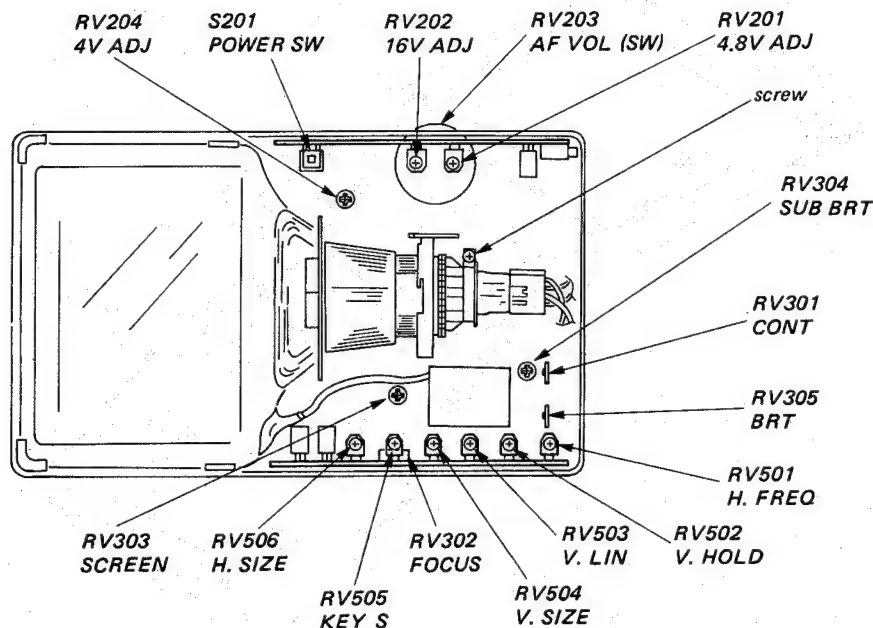
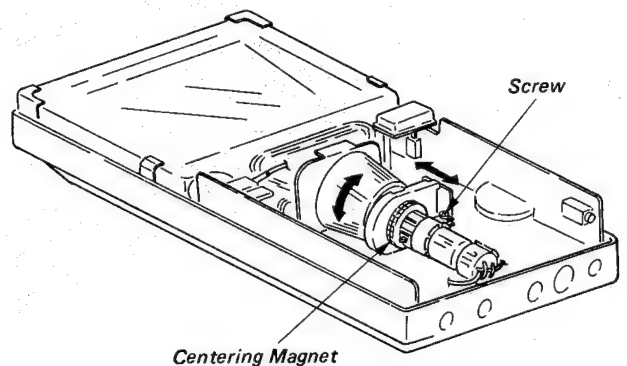
2-2. CIRCUIT ADJUSTMENTS

Cetering adjustment

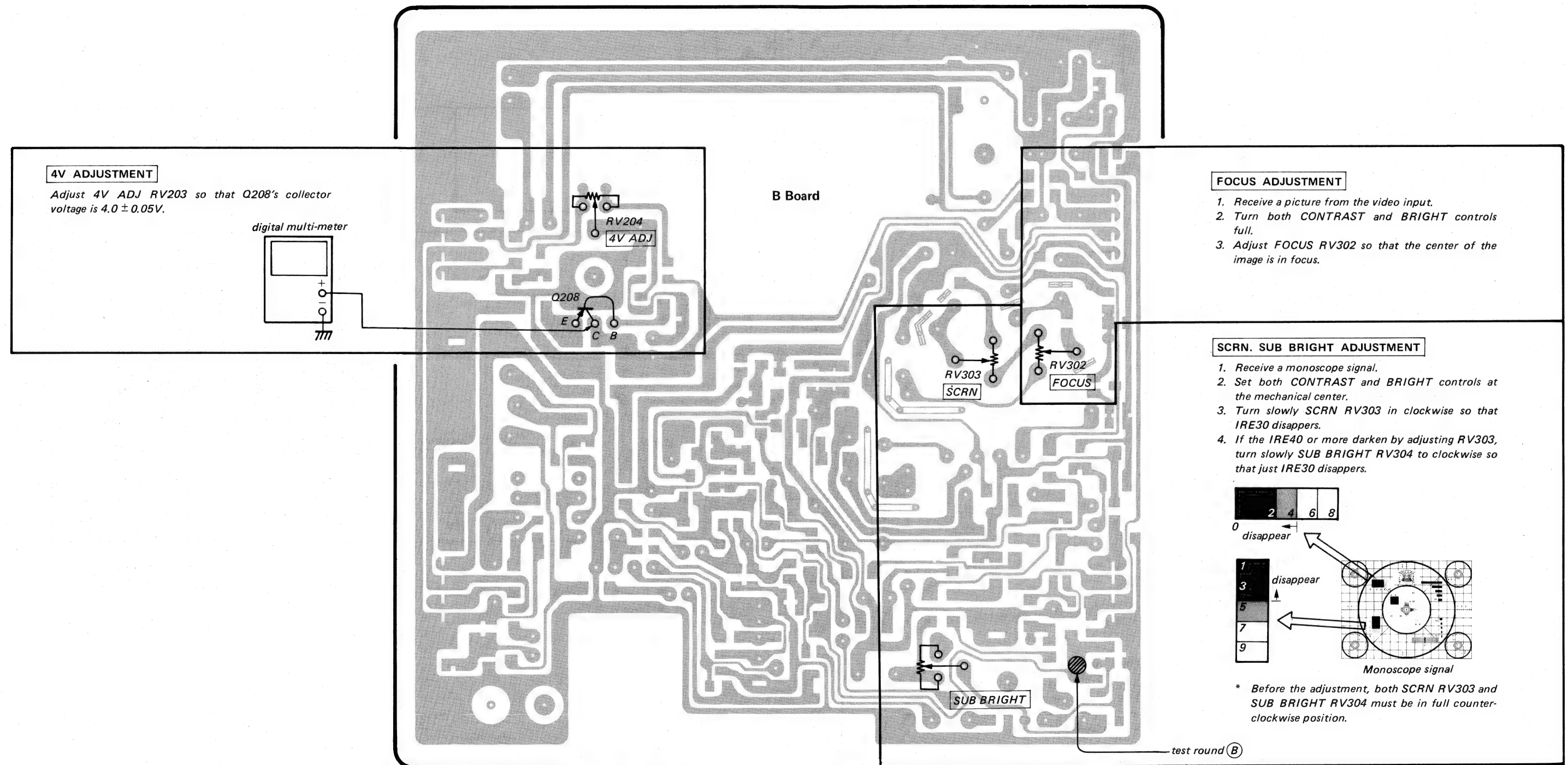
- 1) Receive a picture from the video input.
- 2) Turn both CONTRAST AND BRIGHT controls full.
- 3) Adjust the magnet so that the center of the image is at the screen center.

DY adjustment

- 1) Receive a picture from the video input.
- 2) Turn both CONTRAST and BRIGHT controls full.
- 3) Adjust the DY so that the image is not inclined and then fix the DY with the screw.



2-2-1. B BOARD ADJUSTMENTS

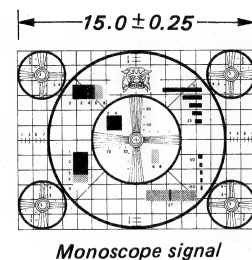


2-2-2. D BOARD ADJUSTMENTS

H SIZE ADJUSTMENT

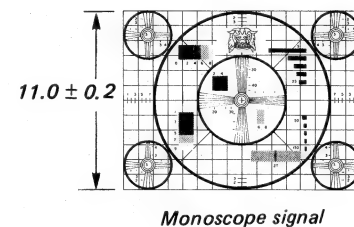
1. Receive a picture from the video input.
2. Adjust the horizontal amplitude with H SIZE RV506.

* If a monoscope signal is used, the horizontal amplitude must be adjusted to 15.0 ± 0.25 columns.



V SIZE ADJUSTMENT

1. Receive a picture from the video input.
 2. Adjust the vertical amplitude with V SIZE RV504.
- * Monoscope signal: 11.0 ± 0.2 columns



V LINE ADJUSTMENT

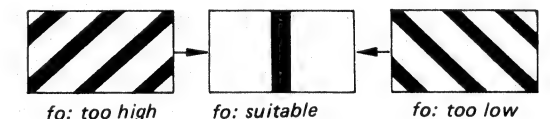
1. Receive a picture from the video input.
2. Adjust the vertical linearity with V LINE RV503.

VERTICAL SYNCHRONIZING SIGNAL ADJUSTMENT

1. Receive a picture from the video input.
2. Adjust V HOLD RV502 so that the picture stops moving vertically.

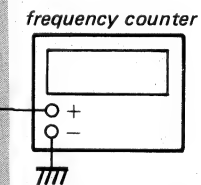
HORIZONTAL OSCILLATION FREQUENCY ADJUSTMENT

1. Strap IC501's pins (9) and (18) with a jumper.
2. Adjust H FREQ RV501 so that the screen is as shown below.



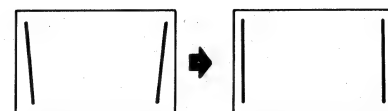
$f_o = 15.734 \pm 0.1\text{kHz}$ at IC501's pin (15) (Measurement point)

3. Remove the jumper.

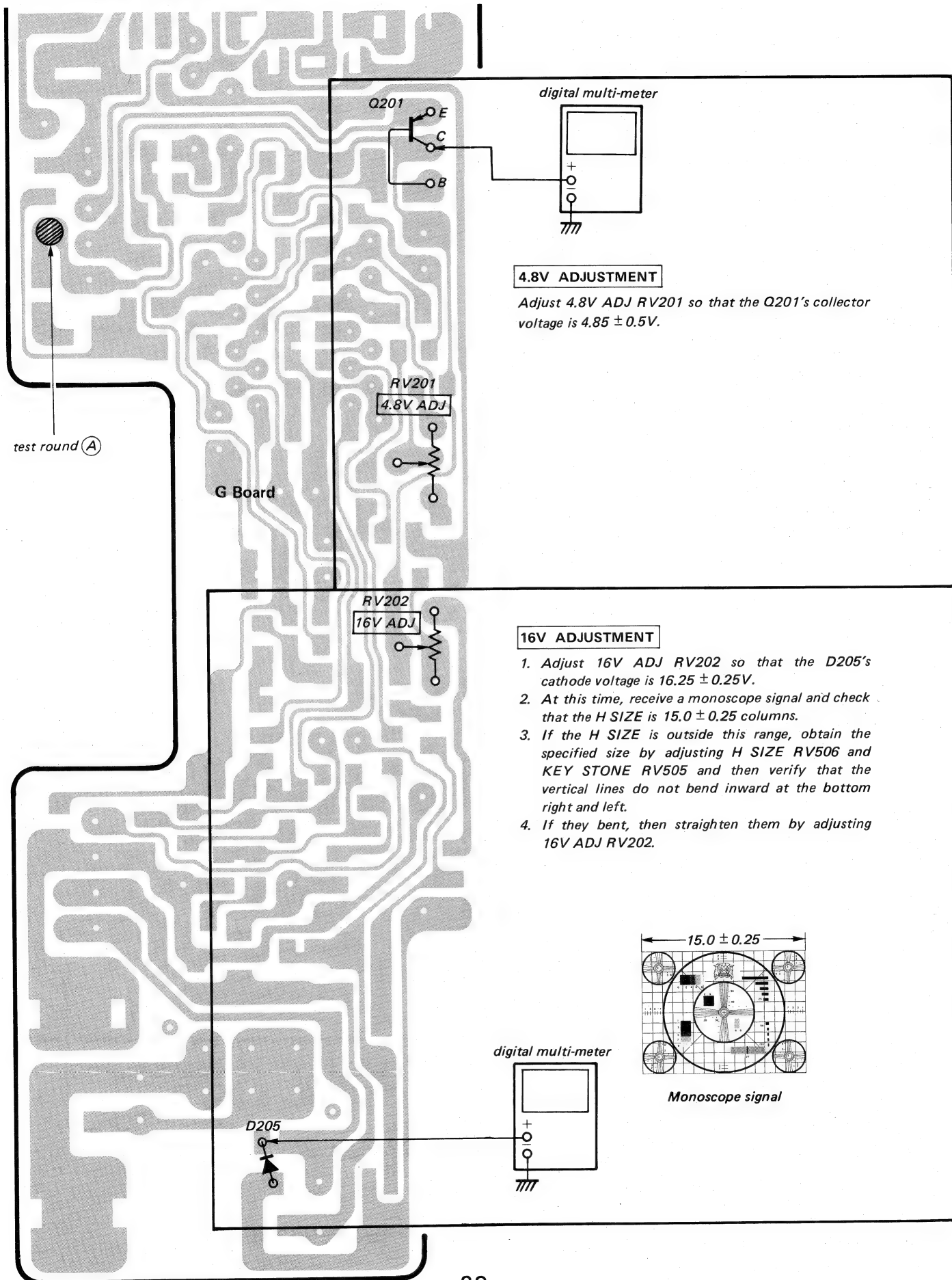


KEY STONE ADJUSTMENT

1. Receive a picture from the video input.
2. Adjust KEY STONE RV505 so that the vertical lines on the left and right are parallel to the sides of the screen as shown.



2-2-3. G BOARD ADJUSTMENTS



2-2-4. HOLD DOWN CIRCUIT ADJUSTMENTS

HOLD DOWN CIRCUIT ADJUSTMENT AND CHECK

1) D208 HOLD DOWN CIRCUIT CHECK

When D208, R237, R238 and/or Q203 are replaced, make the following check:

Confirm that when a $9.45 \pm 0.05V$ DC is externally applied to DC IN the HOLD DOWN CIRCUIT operates and the raster disappears.

Condition: Signal Monoscope signal
BRIGHT At the mechanical center
CONTRAST At the mechanical center

2) D201 HOLD DOWN CIRCUIT CHECK

When D201, R210, R211 and/or IC201 are replaced, perform the following checks:

(1) Unsolder test round (A) to open the circuit and externally apply a $5.80 \pm 0.05V$ DC to the R210 side of the test round and then check that HOLD DOWN CIRCUIT operates and raster disappears.

Condition: Signal Monoscope signal
BRIGHT At the mechanical center
CONTRAST At the mechanical center
Input 6.0V DC

(2) Resolder the test round (A) to close the circuit.

(3) Using a tester check that the Q201 collector and R210 +B (5V) side round are conducting.

3) D303 HOLD DOWN CIRCUIT CHECK

When D303 and/or R315 are replaced, make the following check:

(1) Unsolder test round (B) to open the circuit and externally apply a $7.20 \pm 0.1V$ DC to the D303's cathode of the test round and then check that HOLD DOWN CIRCUIT operates and the raster disappears.

Condition: Signal Monoscope signal
BRIGHT At the mechanical center
CONTRAST At the mechanical center
Input 6.0V DC

(2) Resolder the test round (B) to close the circuit.

(3) Using a tester check that the connector CN202's pin (1) and D303's cathode side round are conducting.

4) +B MAXIMUM VALUE CHECK

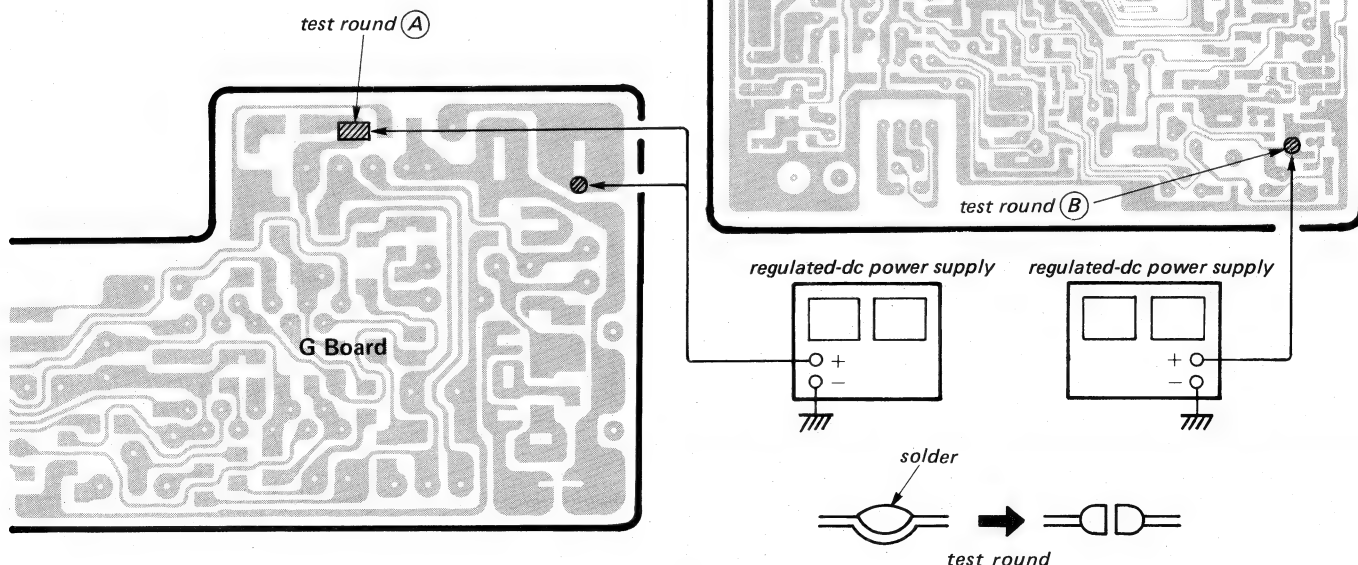
When R203, R204, RV201, and/or IC201 are replaced, perform the following check:

Test voltage: 6.6V DC

Set RV201 at its maximum when a $6.6^{+0.3}_{-0} V$ DC

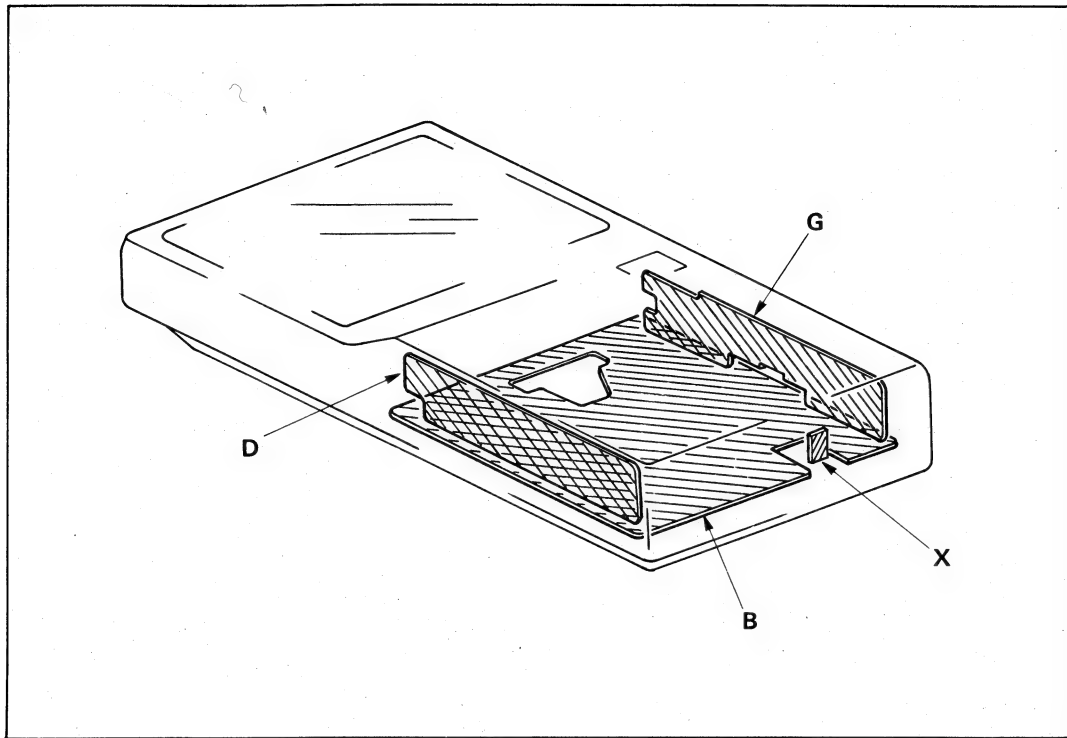
is input and check that a +B (4.85V) output voltage is 5.7V or less.

Condition: Signal Monoscope signal
BRIGHT At the mechanical center
CONTRAST At the mechanical center

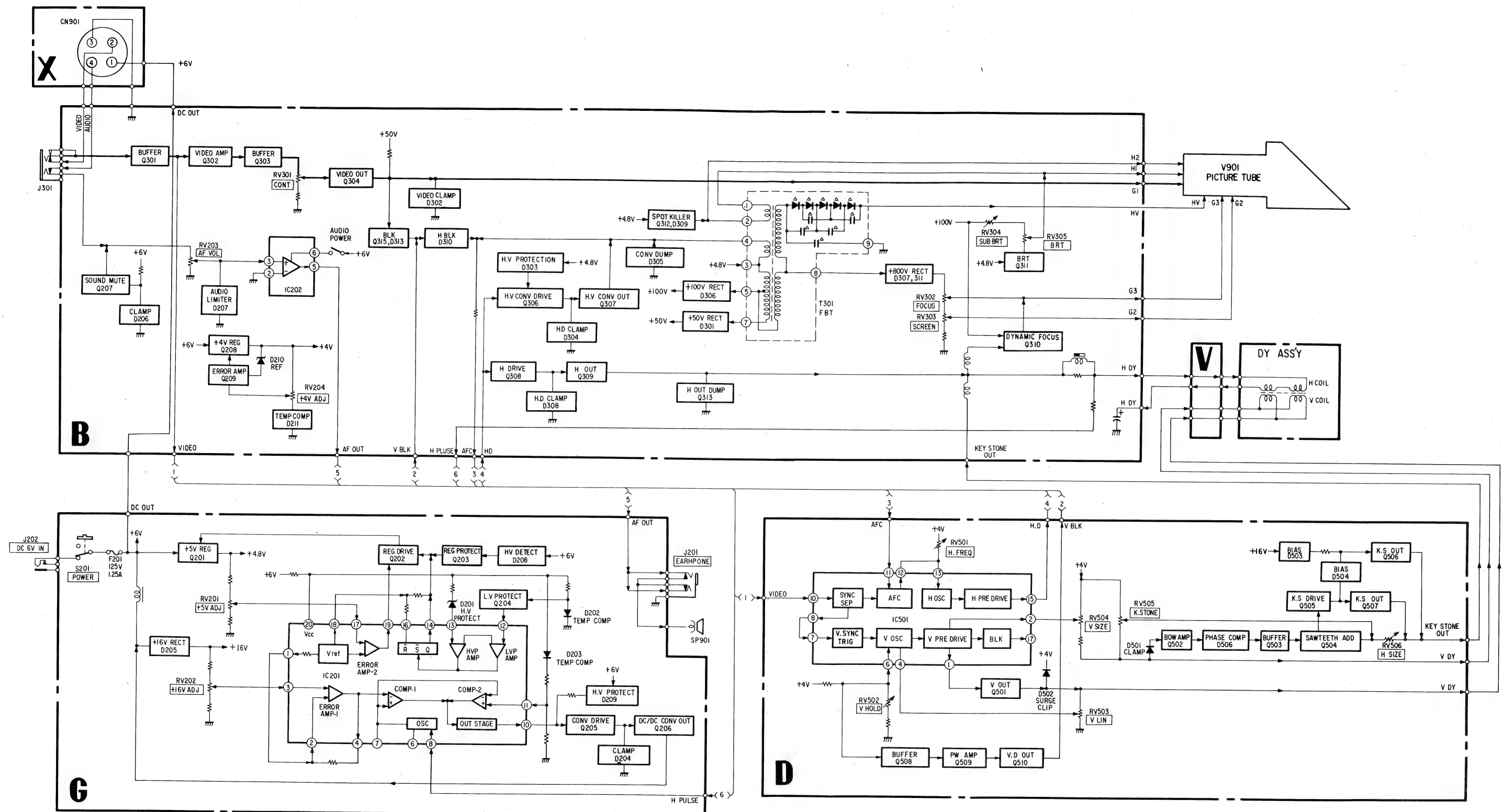


SECTION 3 DIAGRAMS


3-1. CIRCUIT BOARDS LOCATION







3-2. BLOCK DIAGRAM

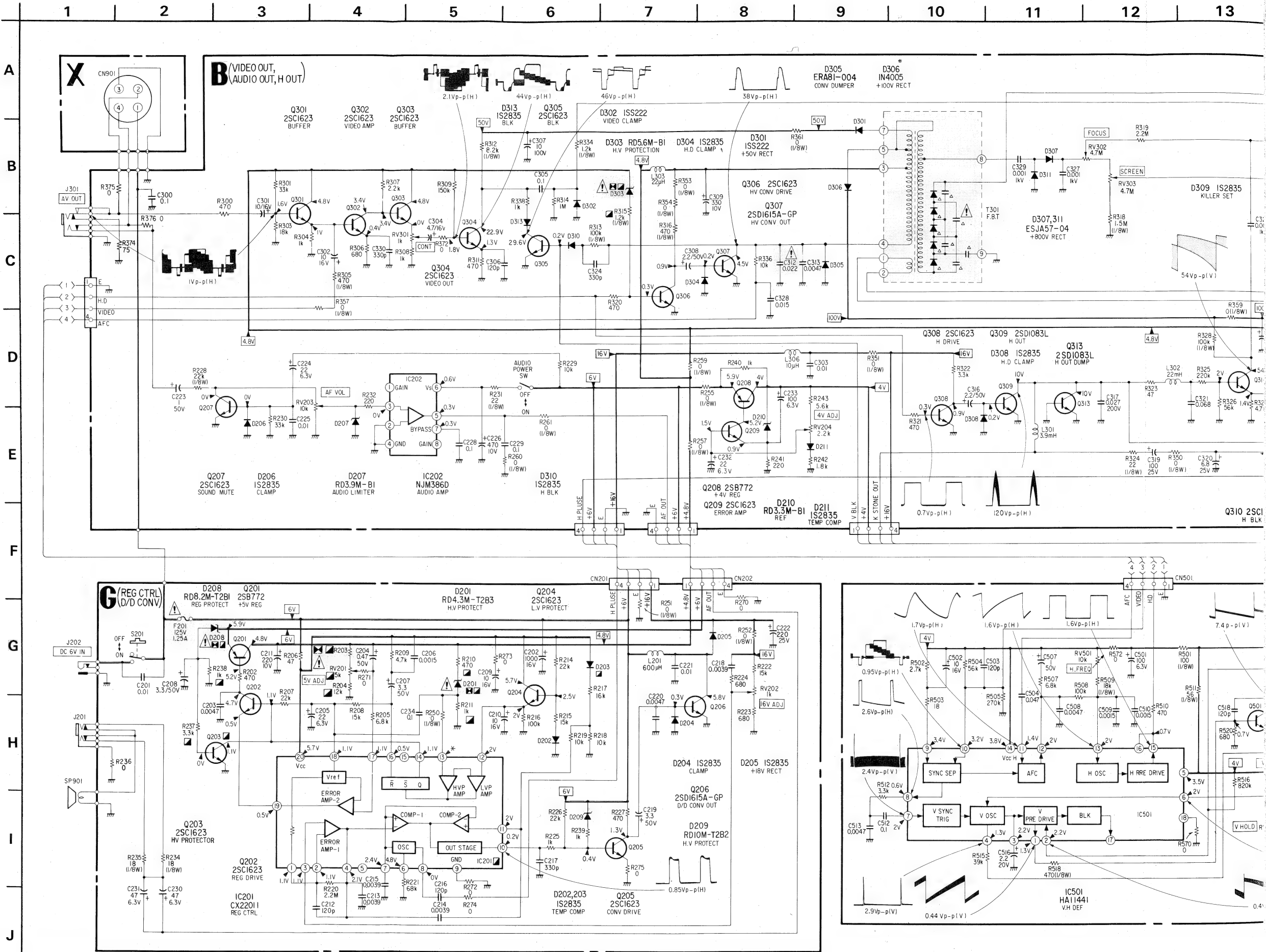


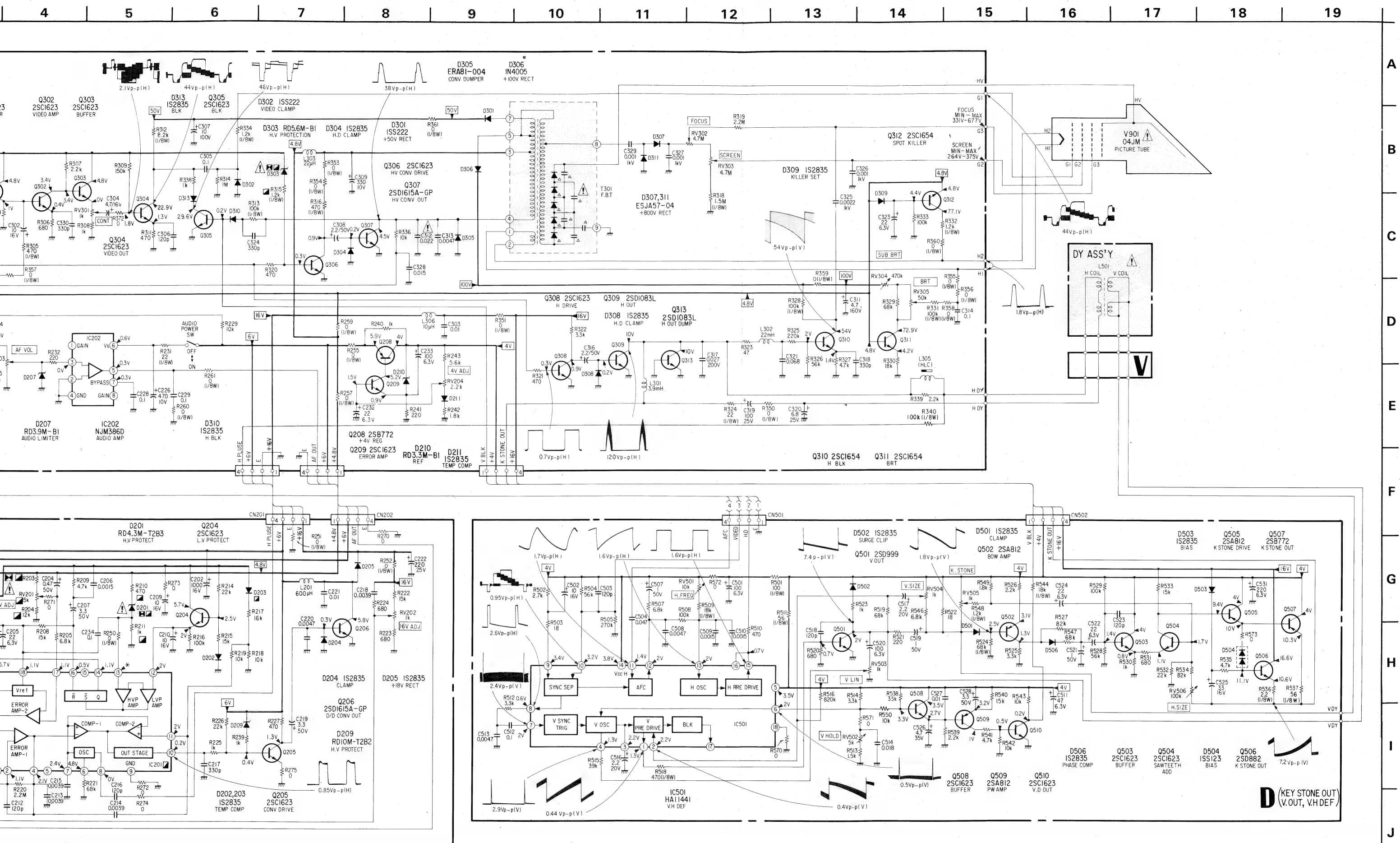
3-3. SCHEMATIC DIAGRAM

Note: The components identified by shading and mark  are critical for safety. Replace only with part number specified.

Note:

- All capacitors are in μF unless otherwise noted. pF : μF F
- All resistors are in ohms, $\frac{1}{10}\text{W}$ unless otherwise noted. $\text{k}\Omega$: 1000Ω , $\text{M}\Omega$: $1000\text{k}\Omega$
-  : nonflammable resistor.
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- \triangle : internal component.
-  : panel designation.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a $10\text{M}\Omega$ digital multimeter.
-  : adjustment for repair.
- Voltage variations may be noted due to normal production tolerances.
-  : B+ bus.
- Readings are taken with a color-bar signal input.





3-4. PRINTED WIRING BOARDS

- Conductor Side -

[KEY STONE OUT]
[V. OUT. V.H DEF]

D

[REG CTRL,
D/D CONV]

G

D

G

V

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

A

- D Board -

IC,Q	506	505	507	504	503	502	501	510	IC501	508	IC,Q
D	503	504					501	502		509	D
ADJ				506	RV506	RV505	RV504	RV503	RV502	RV501	ADJ

B

C

D

E

F

G

H

I

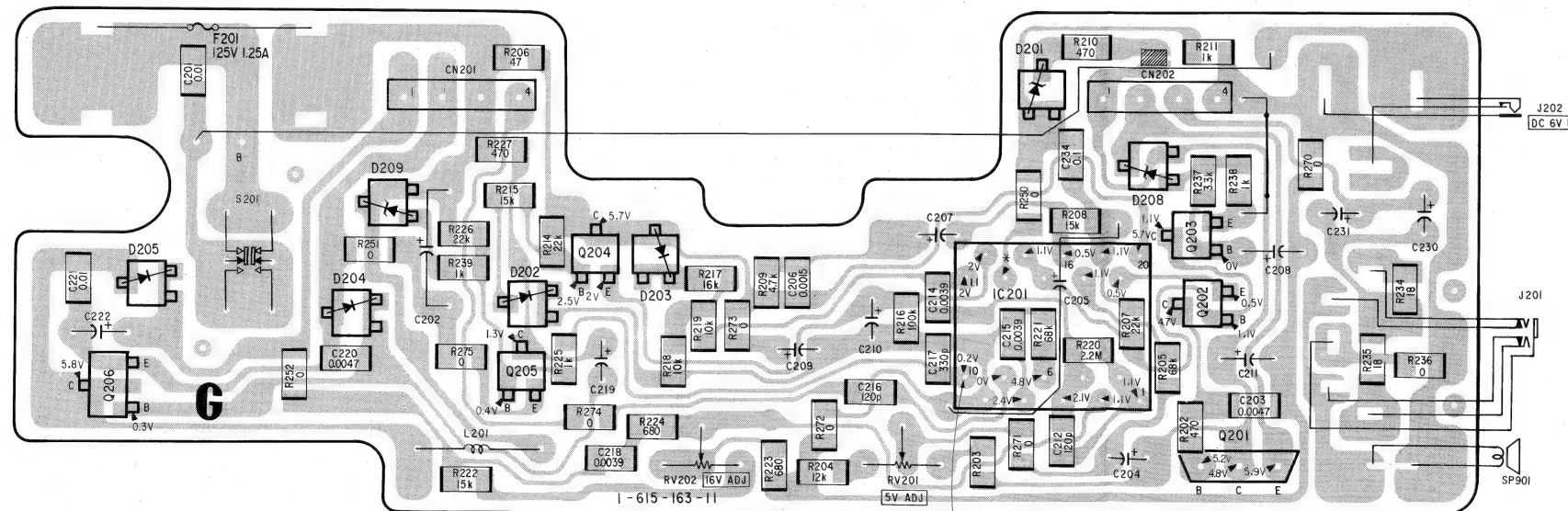
D

I-615-614-11

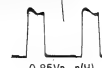
7.2Vp-p (V) 1.8Vp-p (V) 7.4Vp-p (V) 0.44Vp-p (V) 0.4Vp-p (V) 1.6Vp-p (H) 1.6Vp-p (H) 2.9Vp-p (V) 1.7Vp-p (H)

- G Board -

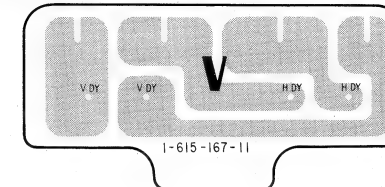
IC,Q	206	205	209	205	204	203	IC201	203	202	201	IC,Q
D							201		208		D
ADJ					RV202	RV201					ADJ



I-615-163-11



- V Board -



VIDEO OUT,
AUDIO OUT, H. OUT

B

X

B

X

1

2

3

4

5

6

7

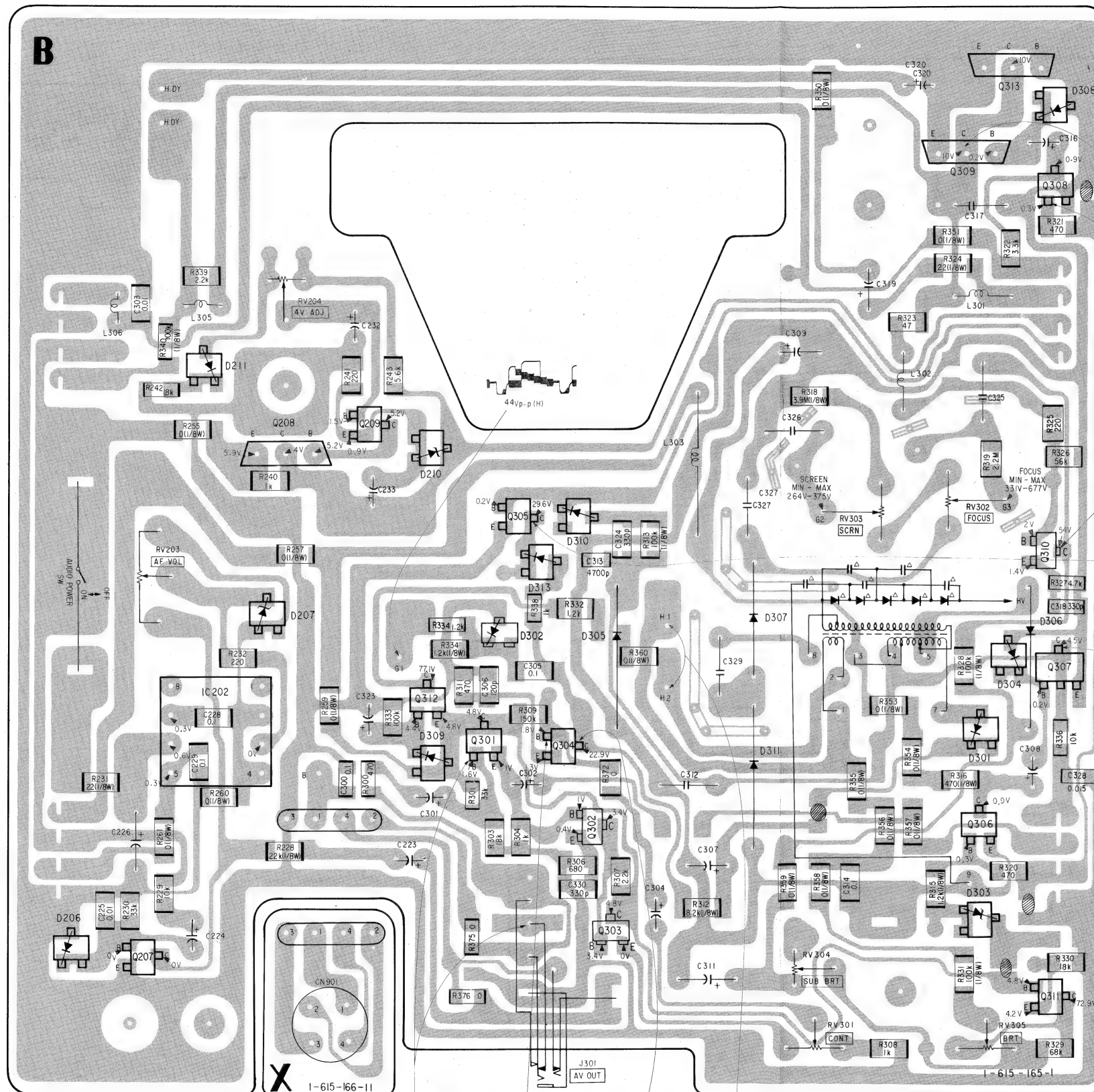
8

9

10

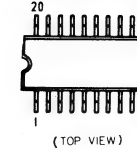
11

-- B Board -- -- X Board --

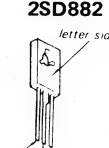
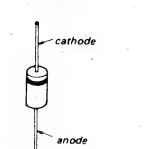


3-5. SEMICONDUCTORS

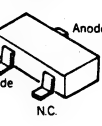
CX22011



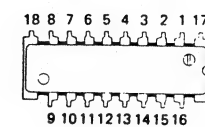
2SB772

ERA81-004
ERA81-005
ESJA57-04
1N4005

1SS222



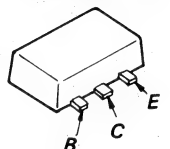
HA11441



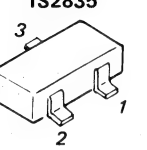
2SD999



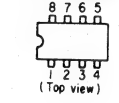
2SD1615A-GP



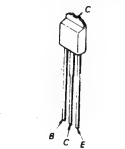
1S2835



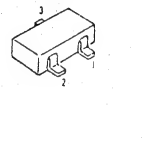
NJM386D



2SD1083L



1SS123



2SA812

2SA1037K

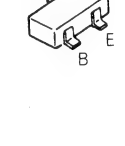
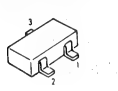
2SA1162

2SC1623

2SC1654

2SC2712

2SC2812

RD10M-B2
RD10M-B3
RD3.3M-B1
RD3.3M-B2
RD3.9M-R1
RD4.3M-B1
RD4.3M-B3
RD4.7M-B1
RD5.6M-B1
RD8.2M-B1
RD8.2M-B2

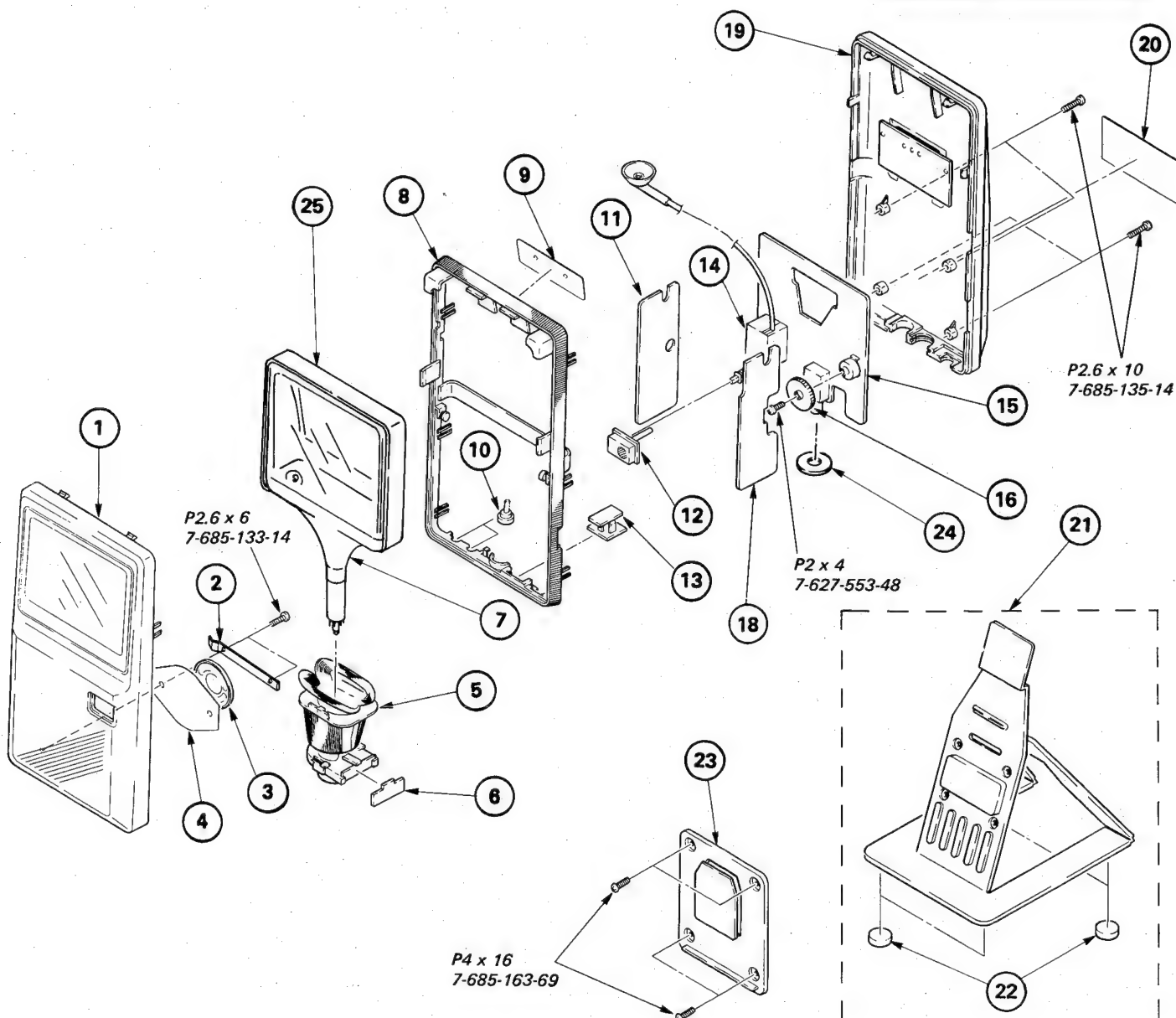
SECTION 4 EXPLODED VIEW

NOTE:

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a collation number in the remark column.

- Items marked " * " are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

The components identified by shading and mark Δ are critical for safety. Replace only with part number specified.



No.	Part No.	Description	Remark	No.	Part No.	Description	Remark
1	X-4375-839-1	CASE ASSY, UPPER		13	*1-615-166-11	X BOARD	
2	*4-375-805-01	RETAINER, S.P		14	Δ 1-439-350-11	TRANSFORMER ASSY, FLYBACK	
3	1-503-293-00	SPEAKER		15	*A-1340-816-A	B BOARD, COMPLETE	
4	4-375-849-01	SHEET, BLIND, SPEAKER		16	4-375-801-01	KNOB, VOL	
5	Δ 1-451-257-21	DEFLECTION YOKE		18	*A-1291-005-A	G BOARD, COMPLETE	
6	*1-615-167-11	V BOARD		19	X-4375-841-1	CASE ASSY, LOWER	
7	Δ 8-736-851-05	CRT (04JM)		20	*4-379-337-01	LABEL, MODEL NUMBER	
8	4-375-812-31	FRAME		21	X-4375-806-1	STAND ASSY	
9	*4-375-804-01	PLATE, GROUND, CRT		22	4-371-227-01	FOOT, RUBBER	
10	4-375-810-01	KNOB, BC		23	4-375-808-01	HOLDER	
11	*A-1311-129-A	D BOARD, COplete		24	*4-375-847-01	PLATE, BLIND, AV	
12	4-375-806-01	BUTTON, POWER		25	4-375-868-01	TAPE, PROTECTION	

22

BSECTION 5
ELECTRICAL PARTS LIST

NOTE:

The components identified by shading and mark **A** are critical for safety. Replace only with part number specified.

When indicating parts by reference number, please include the board name.

• Items marked " * " are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

• All variable and adjustable resistors have characteristic curve B, unless otherwise noted.

CAPACITORS
• MF : μ F, PF : μ F

RESISTORS
• All resistors are in ohms
• F : nonflammable

COILS
• MMH : mH, UH : μ H

• The components identified by **A** in this parts list have been carefully factory-selected for each set in order to satisfy regulations regarding X-ray radiation. Should replacement be required, replace only with the value originally used.

Ref.No.	Part No.	Description	Remark	Ref.No.	Part No.	Description	Remark
	*A-1340-816-A	B BOARD, COMPLETE *****		D306	8-719-904-05	DIODE 1N4005	
	1-526-828-11	SOCKET ASSY, CRT		D307	8-719-903-28	DIODE ESJA57-04	
		<u>CAPACITOR</u>		D308	8-719-100-03	DIODE 1S2835	
C223	1-124-255-00	ELECT 1MF 20% 50V		D309	8-719-100-03	DIODE 1S2835	
C224	1-124-222-00	ELECT 22MF 20% 6.3V		D310	8-719-100-03	DIODE 1S2835	
C225	1-163-021-00	CERAMIC CHIP 0.01MF 10% 50V				<u>IC</u>	
C226	1-124-142-00	ELECT 470MF 20% 10V		IC202	8-759-700-89	IC NJM386D	
C228	1-163-077-00	CERAMIC CHIP 0.1MF 50V				<u>JACK</u>	
C229	1-163-038-00	CERAMIC CHIP 0.1MF 25V		J301	1-507-972-11	JACK, AV (WITH SWITCH)	
C232	1-124-222-00	ELECT 22MF 20% 6.3V				<u>COIL</u>	
C233	1-124-225-00	ELECT 100MF 20% 6.3V		L301	1-407-499-00	MICRO INDUCTOR 3.9MMH	
C300	1-163-038-00	CERAMIC CHIP 0.1MF 25V		L302	1-407-508-00	MICRO INDUCTOR 22MMH	
C301	1-124-233-00	ELECT 10MF 20% 16V		L303	1-408-121-00	MICRO INDUCTOR 22UH	
C302	1-124-233-00	ELECT 10MF 20% 16V		L305	1-459-612-11	HLC	
C303	1-163-021-00	CERAMIC CHIP 0.01MF 10% 50V		L306	1-408-970-21	MICRO INDUCTOR 10UH	
C304	1-124-245-00	ELECT 4.7MF 20% 16V				<u>TRANSISTOR</u>	
C305	1-163-077-00	CERAMIC CHIP 0.1MF 50V		Q207	8-729-100-66	TRANSISTOR 2SC1623	
C306	1-163-119-00	CERAMIC CHIP 120PF 5% 50V		Q208	8-729-177-23	TRANSISTOR 2SB772	
C307	1-123-384-00	ELECT 10MF 20% 100V		Q209	8-729-100-66	TRANSISTOR 2SC1623	
C308	1-124-257-00	ELECT 2.2MF 20% 50V		Q301	8-729-100-66	TRANSISTOR 2SC1623	
C309	1-124-604-00	ELECT 330MF 20% 10V		Q302	8-729-100-66	TRANSISTOR 2SC1623	
C311	1-123-932-00	ELECT 4.7MF 160V		Q303	8-729-100-66	TRANSISTOR 2SC1623	
C312	A 1-108-587-12	MYLAR 0.022MF 5% 50V		Q304	8-729-100-66	TRANSISTOR 2SC1623	
C313	1-163-017-00	CERAMIC CHIP 0.0047MF 10% 50V		Q305	8-729-100-66	TRANSISTOR 2SC1623	
C314	1-163-077-00	CERAMIC CHIP 0.1MF 50V		Q306	8-729-100-66	TRANSISTOR 2SC1623	
C316	1-124-257-00	ELECT 2.2MF 20% 50V		Q307	8-729-106-68	TRANSISTOR 2SD1615A-GP	
C317	1-106-377-00	MYLAR 0.027MF 5% 200V		Q308	8-729-100-66	TRANSISTOR 2SC1623	
C318	1-163-129-00	CERAMIC CHIP 330PF 10% 50V		Q309	8-729-301-87	TRANSISTOR 2SD1083L	
C319	1-123-333-00	ELECT 100MF 20% 25V		Q310	8-729-103-52	TRANSISTOR 2SC1654	
C320	1-127-511-00	ELECT(SOLID) 6.8MF 20% 25V		Q311	8-729-103-52	TRANSISTOR 2SC1654	
C321	1-163-833-00	CERAMIC CHIP 0.068MF 25V		Q312	8-729-103-52	TRANSISTOR 2SC1654	
C323	1-124-222-00	ELECT 22MF 20% 6.3V		Q313	8-729-301-87	TRANSISTOR 2SD1083L	
C324	1-163-041-00	CERAMIC CHIP 330PF 10% 50V				<u>RESISTOR</u>	
C325	1-162-147-00	CERAMIC 0.0022MF 1KV		R228	1-216-230-00	METAL CHIP 22K 5% 1/8W	
C326	1-162-146-00	CERAMIC 0.001MF 1KV		R229	1-216-073-00	METAL CHIP 10K 5% 1/10W	
C327	1-162-146-00	CERAMIC 0.001MF 1KV		R230	1-216-085-00	METAL CHIP 33K 5% 1/10W	
C328	1-163-023-00	CERAMIC CHIP 0.015MF 10% 50V		R231	1-216-158-00	METAL CHIP 22 5% 1/8W	
C329	1-162-146-00	CERAMIC 0.001MF 1KV		R232	1-216-033-00	METAL CHIP 220 5% 1/10W	
C330	1-163-129-00	CERAMIC CHIP 330PF 10% 50V		R240	1-216-049-00	METAL CHIP 1K 5% 1/10W	
		<u>DIODE</u>		R241	1-216-033-00	METAL CHIP 220 5% 1/10W	
D206	8-719-100-03	DIODE 1S2835		R242	1-216-055-00	METAL CHIP 1.8K 5% 1/10W	
D207	8-719-105-57	DIODE RD3.9M-B1		R243	1-216-067-00	METAL CHIP 5.6K 5% 1/10W	
D210	8-719-105-45	DIODE RD3.3M-B1		R255	1-216-296-00	METAL CHIP 0 5% 1/8W	
D211	8-719-100-03	DIODE 1S2835		R257	1-216-296-00	METAL CHIP 0 5% 1/8W	
D301	8-719-108-19	DIODE 1S5222					
D302	8-719-108-19	DIODE 1S5222					
A D303	A	DIODE					
D304	8-719-100-03	DIODE 1S2835					
D305	8-719-981-01	DIODE ERA81-004					

B G

Ref.No.	Part No.	Description	Remark	Ref.No.	Part No.	Description	Remark
R260	1-216-296-00	METAL CHIP 0 5% 1/8W		R377	1-216-295-00	METAL CHIP 0 5% 1/10W	
R261	1-216-296-00	METAL CHIP 0 5% 1/8W				VARIABLE RESISTOR	
R300	1-216-041-00	METAL CHIP 470 5% 1/10W		RV203	1-230-824-11	RES, VAR, CARBON (WITH SW) 10K	
R301	1-216-085-00	METAL CHIP 33K 5% 1/10W		RV204	1-230-521-11	RES, ADJ, METAL GLAZE 2.2K	
R303	1-216-079-00	METAL CHIP 18K 5% 1/10W		RV301	1-226-428-00	RES, ADJ, CARBON 1K	
R304	1-216-049-00	METAL CHIP 1K 5% 1/10W		RV302	1-237-251-21	RES, ADJ, METAL FILM 4.7M	
R305	1-216-190-00	METAL CHIP 470 5% 1/8W		RV303	1-237-250-41	RES, ADJ, METAL GLAZE 4.7M	
R306	1-216-045-00	METAL CHIP 680 5% 1/10W		RV304	1-230-529-11	RES, ADJ, METAL GLAZE 470K	
R307	1-216-057-00	METAL CHIP 2.2K 5% 1/10W		RV305	1-226-433-00	RES, ADJ, CARBON 50K	
R308	1-216-049-00	METAL CHIP 1K 5% 1/10W				TRANSFORMER	
R309	1-216-101-00	METAL CHIP 150K 5% 1/10W		T301	1-439-350-11	TRANSFORMER ASSY, FLYBACK	
R311	1-216-041-00	METAL CHIP 470 5% 1/10W				*****	
R312	1-216-220-00	METAL CHIP 8.2K 5% 1/8W				*A-1291-005-A G BOARD, COMPLETE	
R313	1-216-246-00	METAL CHIP 100K 5% 1/8W				*****	
R314	1-216-121-00	METAL CHIP 1M 5% 1/10W				*1-533-146-00 HOLDER, FUSE	
R315	1-216-200-00	METAL CHIP 1.2K 5% 1/8W				CAPACITOR	
R316	1-216-190-00	METAL CHIP 470 5% 1/8W		C201	1-163-021-00	CERAMIC CHIP 0.01MF 10% 50V	
R318	1-216-274-00	METAL CHIP 1.5M 5% 1/8W		C202	1-123-839-00	ELECT 1000MF 20% 16V	
R319	1-216-129-00	METAL CHIP 2.2M 5% 1/10W		C203	1-163-055-00	CERAMIC CHIP 0.0047MF 10% 50V	
R320	1-216-041-00	METAL CHIP 470 5% 1/10W		C204	1-124-253-00	ELECT 0.47MF 20% 50V	
R321	1-216-041-00	METAL CHIP 470 5% 1/10W		C205	1-124-222-00	ELECT 22MF 20% 6.3V	
R322	1-216-061-00	METAL CHIP 3.3K 5% 1/10W		C206	1-163-145-00	CERAMIC CHIP 0.0015MF 10% 50V	
R323	1-216-017-00	METAL CHIP 47 5% 1/10W		C207	1-124-258-00	ELECT 3.3MF 20% 50V	
R324	1-216-158-00	METAL CHIP 22 5% 1/8W		C208	1-124-258-00	ELECT 3.3MF 20% 50V	
R325	1-216-105-00	METAL CHIP 220K 5% 1/10W		C209	1-124-233-00	ELECT 10MF 20% 16V	
R326	1-216-091-00	METAL CHIP 56K 5% 1/10W		C210	1-124-233-00	ELECT 10MF 20% 16V	
R327	1-216-065-00	METAL CHIP 4.7K 5% 1/10W		C211	1-124-140-00	ELECT 220MF 20% 10V	
R328	1-216-246-00	METAL CHIP 100K 5% 1/8W		C212	1-163-119-00	CERAMIC CHIP 120PF 5% 50V	
R329	1-216-093-00	METAL CHIP 68K 5% 1/10W		C213	1-163-016-00	CERAMIC CHIP 0.0039MF 10% 50V	
R330	1-216-079-00	METAL CHIP 18K 5% 1/10W		C214	1-163-016-00	CERAMIC CHIP 0.0039MF 10% 50V	
R331	1-216-246-00	METAL CHIP 100K 5% 1/8W		C215	1-163-016-00	CERAMIC CHIP 0.0039MF 10% 50V	
R332	1-216-200-00	METAL CHIP 1.2K 5% 1/8W		C216	1-163-119-00	CERAMIC CHIP 120PF 5% 50V	
R333	1-216-097-00	METAL CHIP 100K 5% 1/10W		C217	1-163-129-00	CERAMIC CHIP 330PF 10% 50V	
R334	1-216-200-00	METAL CHIP 1.2K 5% 1/8W		C218	1-163-016-00	CERAMIC CHIP 0.0039MF 10% 50V	
R336	1-216-073-00	METAL CHIP 10K 5% 1/10W		C219	1-124-258-00	ELECT 3.3MF 20% 50V	
R338	1-216-049-00	METAL CHIP 1K 5% 1/10W		C220	1-163-017-00	CERAMIC CHIP 0.0047MF 10% 50V	
R339	1-216-057-00	METAL CHIP 2.2K 5% 1/10W		C221	1-163-021-00	CERAMIC CHIP 0.01MF 10% 50V	
R340	1-216-246-00	METAL CHIP 100K 5% 1/8W		C222	1-124-599-00	ELECT 220MF 20% 25V	
R350	1-216-296-00	METAL CHIP 0 5% 1/8W		C230	1-124-224-00	ELECT 47MF 20% 6.3V	
R351	1-216-296-00	METAL CHIP 0 5% 1/8W		C231	1-124-224-00	ELECT 47MF 20% 6.3V	
R353	1-216-296-00	METAL CHIP 0 5% 1/8W		C234	1-163-038-00	CERAMIC CHIP 0.1MF 25V	
R354	1-216-296-00	METAL CHIP 0 5% 1/8W				CONNECTOR	
R355	1-216-296-00	METAL CHIP 0 5% 1/8W		CN201	*1-564-047-00	PIN, CONNECTOR (L TYPE) 4P	
R356	1-216-296-00	METAL CHIP 0 5% 1/8W		CN202	*1-564-047-00	PIN, CONNECTOR (L TYPE) 4P	
R357	1-216-296-00	METAL CHIP 0 5% 1/8W					
R358	1-216-296-00	METAL CHIP 0 5% 1/8W					
R359	1-216-296-00	METAL CHIP 0 5% 1/8W					
R360	1-216-296-00	METAL CHIP 0 5% 1/8W					
R361	1-216-295-00	METAL CHIP 0 5% 1/10W					
R372	1-216-295-00	METAL CHIP 0 5% 1/10W					
R374	1-216-022-00	METAL CHIP 75 5% 1/10W					
R375	1-216-295-00	METAL CHIP 0 5% 1/10W					
R376	1-216-295-00	METAL CHIP 0 5% 1/10W					

NOTE:

The components identified by shading and mark **A** are critical for safety. Replace only with part number specified.

G

D

Ref.No.	Part No.	Description	Remark	Ref.No.	Part No.	Description	Remark
<u>DIODE</u>				R224	1-216-045-00	METAL CHIP 680 5% 1/10W	
✕ D201 A		DIODE		R225	1-216-049-00	METAL CHIP 1K 5% 1/10W	
D202	8-719-100-03	DIODE 1S2835		R226	1-216-081-00	METAL CHIP 22K 5% 1/10W	
D203	8-719-100-03	DIODE 1S2835		R227	1-216-041-00	METAL CHIP 470 5% 1/10W	
D204	8-719-100-03	DIODE 1S2835		R234	1-216-156-00	METAL CHIP 18 5% 1/8W	
D205	8-719-100-03	DIODE 1S2835		R235	1-216-156-00	METAL CHIP 18 5% 1/8W	
✕ D208 A		DIODE		R236	1-216-295-00	METAL CHIP 0 5% 1/10W	
D209	8-719-106-53	DIODE RD10M-B2		R237	1-216-061-00	METAL CHIP 3.3K 5% 1/10W	
<u>FUSE</u>				R238	1-216-049-00	METAL CHIP 1K 5% 1/10W	
F201 A	1-532-570-11	FUSE, GLASS TUBE 1.25A/125V		R239	1-216-049-00	METAL CHIP 1K 5% 1/10W	
<u>IC</u>				R250	1-216-296-00	METAL CHIP 0 5% 1/8W	
IC201	8-759-600-26	IC CX22011		R251	1-216-296-00	METAL CHIP 0 5% 1/8W	
<u>JACK</u>				R252	1-216-296-00	METAL CHIP 0 5% 1/8W	
J201	1-507-838-00	JACK		R270	1-216-295-00	METAL CHIP 0 5% 1/10W	
J202	1-507-563-00	D C JACK		R271	1-216-295-00	METAL CHIP 0 5% 1/10W	
<u>COIL</u>				R272	1-216-295-00	METAL CHIP 0 5% 1/10W	
L201	1-459-611-11	COIL, CHOKE 600UH		R273	1-216-295-00	METAL CHIP 0 5% 1/10W	
<u>TRANSISTOR</u>				R274	1-216-295-00	METAL CHIP 0 5% 1/10W	
Q201	8-729-177-23	TRANSISTOR 2SB772		R275	1-216-295-00	METAL CHIP 0 5% 1/10W	
Q202	8-729-100-66	TRANSISTOR 2SC1623		<u>VARIABLE RESISTOR</u>			
Q203	8-729-100-66	TRANSISTOR 2SC1623		RV201	1-230-610-11	RES, ADJ, CARBON 5K	
Q204	8-729-100-66	TRANSISTOR 2SC1623		RV202	1-228-919-00	RES, ADJ, CARBON 1K	
Q205	8-729-100-66	TRANSISTOR 2SC1623		<u>SWITCH</u>			
Q206	8-729-106-68	TRANSISTOR 2SD1615A-GP		S201	1-554-358-00	SWITCH, PUSH	
<u>RESISTOR</u>				*****			
R202	1-216-041-00	METAL CHIP 470 5% 1/10W		*A-1311-129-A D BOARD, COMPLETE			
✕ R203 A		METAL CHIP 1/10W		*****			
R204	1-216-075-00	METAL CHIP 12K 5% 1/10W		<u>CAPACITOR</u>			
R205	1-216-069-00	METAL CHIP 6.8K 5% 1/10W		C501	1-124-225-00	ELECT 100MF 20% 6.3V	
R206	1-216-017-00	METAL CHIP 47 5% 1/10W		C502	1-124-233-00	ELECT 10MF 20% 16V	
R207	1-216-081-00	METAL CHIP 22K 5% 1/10W		C503	1-163-119-00	CERAMIC CHIP 120PF 5% 50V	
R208	1-216-077-00	METAL CHIP 15K 5% 1/10W		C504	1-163-035-00	CERAMIC CHIP 0.047MF 50V	
R209	1-216-065-00	METAL CHIP 4.7K 5% 1/10W		C507	1-124-255-00	ELECT 1MF 20% 50V	
R210	1-216-041-00	METAL CHIP 470 5% 1/10W		C508	1-163-055-00	CERAMIC CHIP 0.0047MF 10% 50V	
R211	1-216-049-00	METAL CHIP 1K 5% 1/10W		C509	1-163-209-00	CERAMIC CHIP 0.0015MF 5% 50V	
R214	1-216-081-00	METAL CHIP 22K 5% 1/10W		C510	1-163-209-00	CERAMIC CHIP 0.0015MF 5% 50V	
R215	1-216-077-00	METAL CHIP 15K 5% 1/10W		C511	1-131-387-00	TANTALUM 47MF 20% 6.3V	
R216	1-216-097-00	METAL CHIP 100K 5% 1/10W		C512	1-163-038-00	CERAMIC CHIP 0.1MF 25V	
R217	1-216-078-00	METAL CHIP 16K 5% 1/10W		C513	1-163-017-00	CERAMIC CHIP 0.0047MF 10% 50V	
R218	1-216-073-00	METAL CHIP 10K 5% 1/10W		C514	1-163-024-00	CERAMIC CHIP 0.018MF 10% 50V	
R219	1-216-073-00	METAL CHIP 10K 5% 1/10W		C516	1-131-361-00	TANTALUM 2.2MF 10% 20V	
R220	1-216-129-00	METAL CHIP 2.2M 5% 1/10W		C517	1-131-361-00	TANTALUM 2.2MF 10% 20V	
R221	1-216-093-00	METAL CHIP 68K 5% 1/10W		C518	1-163-119-00	CERAMIC CHIP 120PF 5% 50V	
R222	1-216-077-00	METAL CHIP 15K 5% 1/10W		C519	1-124-255-00	ELECT 1MF 20% 50V	
R223	1-216-045-00	METAL CHIP 680 5% 1/10W		C520	1-124-225-00	ELECT 100MF 20% 6.3V	
				C521	1-124-255-00	ELECT 1MF 20% 50V	
				C522	1-124-222-00	ELECT 22MF 20% 6.3V	
				C523	1-163-119-00	CERAMIC CHIP 120PF 5% 50V	

- The components identified by ✕ in this parts list have been carefully factory-selected for each set in order to satisfy regulations regarding X-ray radiation. Should replacement be required, replace only with the value originally used.

NOTE:

The components identified by shading and mark A are critical for safety. Replace only with part number specified.

D

X

V

Ref.No.	Part No.	Description	Remark	Ref.No.	Part No.	Description	Remark
C524	1-124-222-00	ELECT 22MF	20% 6.3V	R527	1-216-097-00	METAL CHIP 100K 5%	1/10W
C525	1-124-242-00	ELECT 33MF	20% 16V	R528	1-216-091-00	METAL CHIP 56K 5%	1/10W
C526	1-124-245-00	ELECT 4.7MF	20% 35V	R529	1-216-097-00	METAL CHIP 100K 5%	1/10W
C527	1-163-021-00	CERAMIC CHIP 0.01MF	10% 50V	R530	1-216-049-00	METAL CHIP 1K 5%	1/10W
C528	1-124-258-00	ELECT 3.3MF	20% 50V	R531	1-216-045-00	METAL CHIP 680 5%	1/10W
C531	1-124-587-11	ELECT 220MF	20% 6.3V	R532	1-216-081-00	METAL CHIP 22K 5%	1/10W
<u>CONNECTOR</u>				R533	1-216-077-00	METAL CHIP 15K 5%	1/10W
CN501	*1-564-047-00	PIN, CONNECTOR (L TYPE) 4P		R534	1-216-095-00	METAL CHIP 82K 5%	1/10W
CN502	*1-564-047-00	PIN, CONNECTOR (L TYPE) 4P		R535	1-216-065-00	METAL CHIP 4.7K 5%	1/10W
<u>DIODE</u>				R536	1-216-134-00	METAL CHIP 2.2 5%	1/8W
D501	8-719-100-03	DIODE 1S2835		R537	1-216-168-00	METAL CHIP 56 5%	1/8W
D502	8-719-100-03	DIODE 1S2835		R538	1-216-085-00	METAL CHIP 33K 5%	1/10W
D503	8-719-100-03	DIODE 1S2835		R539	1-216-057-00	METAL CHIP 2.2K 5%	1/10W
D504	8-719-101-23	DIODE 1SS123		R540	1-216-077-00	METAL CHIP 15K 5%	1/10W
D506	8-719-100-03	DIODE 1S2835		R541	1-216-065-00	METAL CHIP 4.7K 5%	1/10W
<u>IC</u>				R542	1-216-073-00	METAL CHIP 10K 5%	1/10W
IC501	8-759-314-41	IC HA11441		R543	1-216-073-00	METAL CHIP 10K 5%	1/10W
<u>TRANSISTOR</u>				R544	1-216-228-00	METAL CHIP 18K 5%	1/8W
Q501	8-729-199-92	TRANSISTOR 2SD999		R546	1-216-061-00	METAL CHIP 3.3K 5%	1/10W
Q502	8-729-100-76	TRANSISTOR 2SA812		R547	1-216-093-00	METAL CHIP 68K 5%	1/10W
Q503	8-729-100-66	TRANSISTOR 2SC1623		R548	1-216-200-00	METAL CHIP 1.2K 5%	1/8W
Q504	8-729-100-66	TRANSISTOR 2SC1623		R549	1-216-055-00	METAL CHIP 1.8K 5%	1/10W
Q505	8-729-100-76	TRANSISTOR 2SA812		R550	1-216-073-00	METAL CHIP 10K 5%	1/10W
Q506	8-729-188-23	TRANSISTOR 2SD882		R570	1-216-295-00	METAL CHIP 0 5%	1/10W
Q507	8-729-177-23	TRANSISTOR 2SB772		R571	1-216-295-00	METAL CHIP 0 5%	1/10W
Q508	8-729-100-66	TRANSISTOR 2SC1623		R572	1-216-295-00	METAL CHIP 0 5%	1/10W
Q509	8-729-100-76	TRANSISTOR 2SA812		R573	1-216-295-00	METAL CHIP 0 5%	1/10W
Q510	8-729-100-66	TRANSISTOR 2SC1623		<u>VARIABLE RESISTOR</u>			
<u>RESISTOR</u>				RV501	1-230-510-11	RES, ADJ, CARBON 10K	
R501	1-216-174-00	METAL CHIP 100 5%	1/8W	RV502	1-230-610-11	RES, ADJ, CARBON 5K	
R502	1-216-059-00	METAL CHIP 2.7K 5%	1/10W	RV503	1-228-919-00	RES, ADJ, CARBON 1K	
R503	1-216-007-00	METAL CHIP 18 5%	1/10W	RV504	1-228-919-00	RES, ADJ, CARBON 1K	
R504	1-216-091-00	METAL CHIP 56K 5%	1/10W	RV505	1-228-919-00	RES, ADJ, CARBON 1K	
R505	1-216-107-00	METAL CHIP 270K 5%	1/10W	RV506	1-230-611-11	RES, ADJ, CARBON 100K	
R507	1-216-069-00	METAL CHIP 6.8K 5%	1/10W	*****			
R508	1-216-097-00	METAL CHIP 100K 5%	1/10W	*1-615-166-11	X BOARD		
R509	1-216-228-00	METAL CHIP 18K 5%	1/8W	*****			
R510	1-216-041-00	METAL CHIP 470 5%	1/10W	*4-375-803-01	BRACKET, CONNECTOR		
R511	1-216-168-00	METAL CHIP 56 5%	1/8W	<u>CONNECTOR</u>			
R512	1-216-061-00	METAL CHIP 3.3K 5%	1/10W	CN901	1-562-892-11	SOCKET, ROUND CONNECTOR 4P	
R513	1-216-053-00	METAL CHIP 1.5K 5%	1/10W	*****			
R514	1-216-061-00	METAL CHIP 3.3K 5%	1/10W	*1-615-167-11	V BOARD		
R515	1-216-087-00	METAL CHIP 39K 5%	1/10W	*****			
R516	1-216-119-00	METAL CHIP 820K 5%	1/10W	<u>MISCELLANEOUS</u>			
R518	1-216-190-00	METAL CHIP 470 5%	1/8W	*****			
R519	1-216-093-00	METAL CHIP 68K 5%	1/10W	<u>ADAPTOR, AC (AC-40E)</u>			
R520	1-216-045-00	METAL CHIP 680 5%	1/10W	*****			
R521	1-216-033-00	METAL CHIP 220 5%	1/10W	<u>DEFLECTION YOKE</u>			
R522	1-216-007-00	METAL CHIP 18 5%	1/10W	*****			
R523	1-216-049-00	METAL CHIP 1K 5%	1/10W	<u>SPEAKER</u>			
R524	1-216-242-00	METAL CHIP 68K 5%	1/8W	*****			
R525	1-216-061-00	METAL CHIP 3.3K 5%	1/10W	<u>CRT (04JM)</u>			
R526	1-216-057-00	METAL CHIP 2.2K 5%	1/10W	*****			

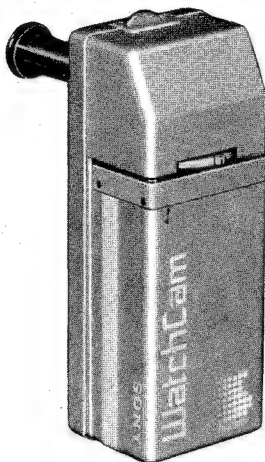
NOTE:

The components identified by shading and mark Δ are critical for safety. Replace only with part number specified.

HVM-304

SERVICE MANUAL

AEP Model



April, 1986

SPECIFICATIONS

HVM-304 black-and-white video camera

Image pickup tube 1/2-inch B/W SATICON™ tube

Signal system CCIR standards

Scanning system 625 lines, 2:1 interlace

Frame 25 frames/sec.

Sync system Internal

Scanning frequency

Horizontal 15.625 kHz

Vertical 50 Hz

Lens $f = 11$ mm, F1.8, fixed focus, auto-iris

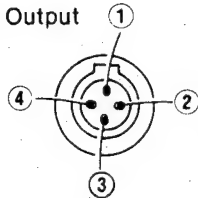
Automatic controls

Auto-gain and auto-beam control

Minimum illumination

5 lux (10 lux when the camera mount and fish-eye lens are incorporated)

Output



4P MULTI connector

① DC input, ② Video output,

③ Ground, ④ Audio output

Video, 1.0V p-p, 75 ohms, sync negative

Audio, -5dBs (436 mVrms) less than 10 kilohms

Input

Power, 5.1 through 15V DC, 6V DC normal

Microphone

Built-in electret condenser type

Power consumption

Approx. 0.9W when the auto-iris is opened

Dimensions

Approx. 52 × 32 × 100 mm (w/h/d)
(2 1/8 × 1 5/16 × 3 15/16 inches)

Weight

Approx. 170g (6 oz)

Camera mount

View angle

Approx. 150 degrees (diagonally)

Door lens

Lens structure, 4 groups 5 elements

Afocal system

Relay lens

Lens structure, 8 groups 8 elements

Afocal magnification × 0.58 with special bayonet mount

Design and specifications are subject to change without notice.

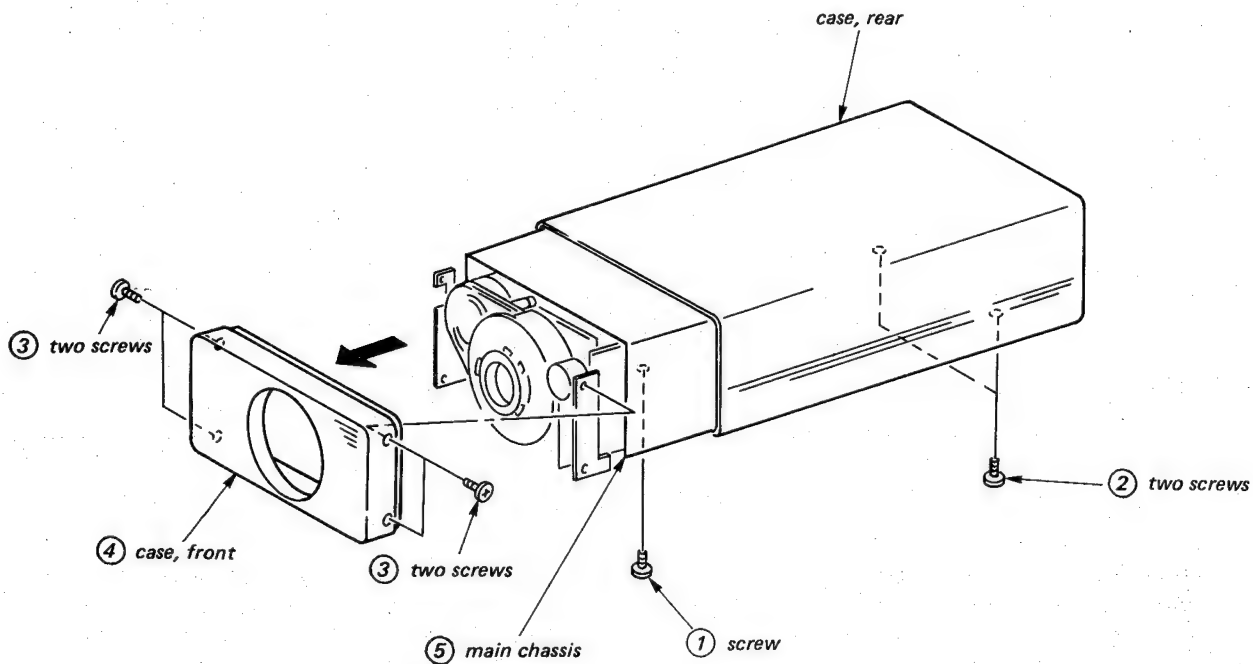


BLACK AND WHITE VIDEO CAMERA
SONY®

SECTION 1 DISASSEMBLY AND REPLACEMENT

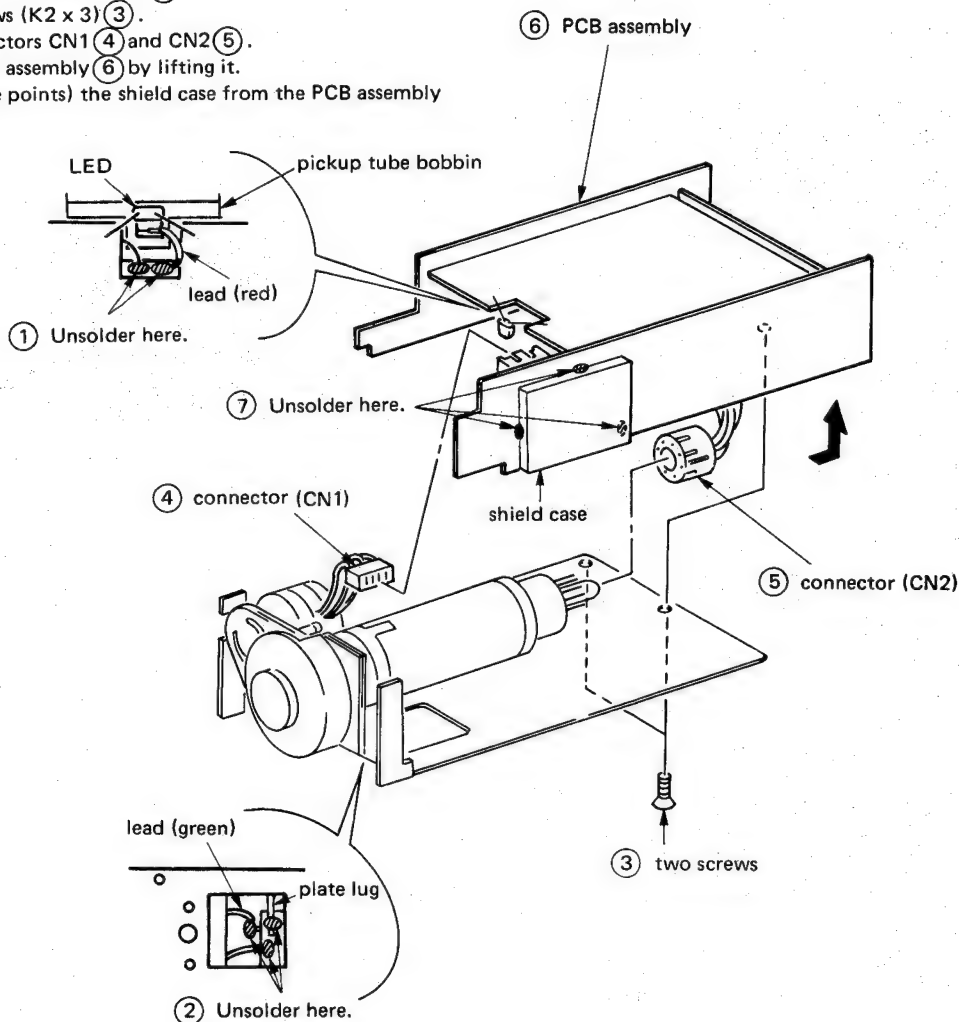
Note: Follow the disassembly procedure in the numerical order given.

1-1. CASE REMOVAL



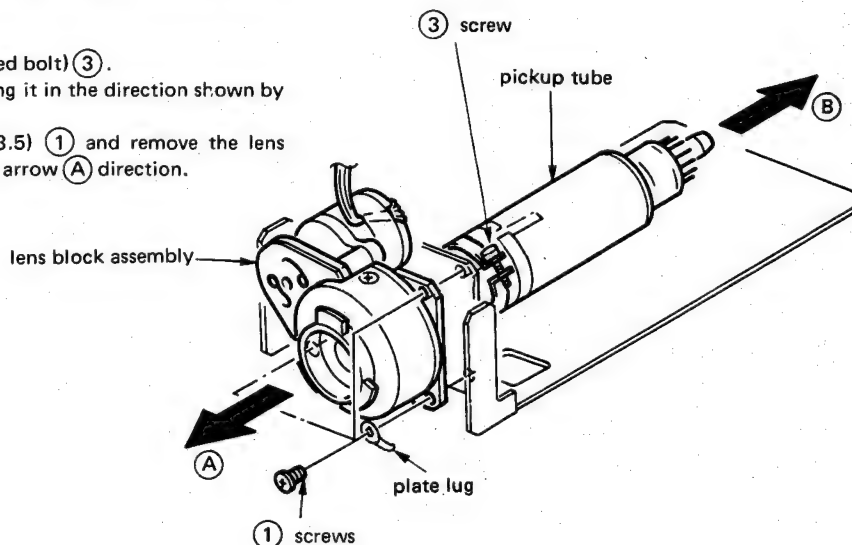
1-2. PCB ASSEMBLY AND SHIELD CASE REMOVAL

- 1) Pull out the LED from the pickup tube bobbin.
- 2) Unsolder the leads at two points (1) in the figure.
- 3) Unsolder the leads at three points (2).
- 4) Remove two screws (K2 x 3) (3).
- 5) Disconnect connectors CN1 (4) and CN2 (5).
- 6) Demount the PCB assembly (6) by lifting it.
- 7) Unsolder (at three points) the shield case from the PCB assembly and remove it (7).



1-3. PICKUP TUBE AND LENS BLOCK ASSEMBLY REMOVAL

- 1) Loosen the screw (hexagonal headed bolt) (3).
- 2) Remove the pickup tube by pulling it in the direction shown by arrow (B).
- 3) Remove the three screws (P2 x 3.5) (1) and remove the lens block assembly by pulling it in the arrow (A) direction.



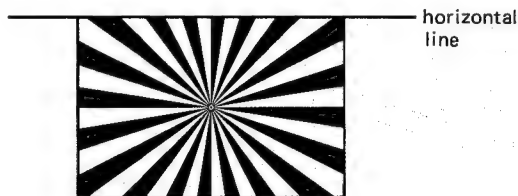
SECTION 2 ADJUSTMENTS

2.1. SETUP ADJUSTMENTS

Flangeback and horizontality adjustments

These adjustments have already been made at the factory before shipment. The focus has been adjusted at 3m.

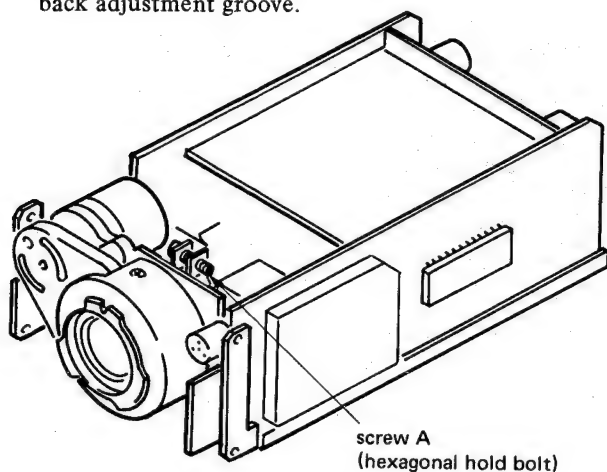
1) Use a pattern as shown below as the subject.



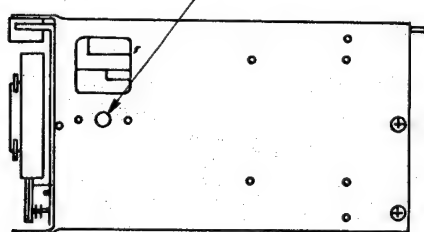
2) Make both camera and subject level.

3) Loosen screw A, adjust the horizontality and focus by the flangeback adjustment groove and then retighten screw A.

To change the distance to the subject, loosen screw A and move the pickup tube back and forth in the flange back adjustment groove.



flangeback adjustment groove

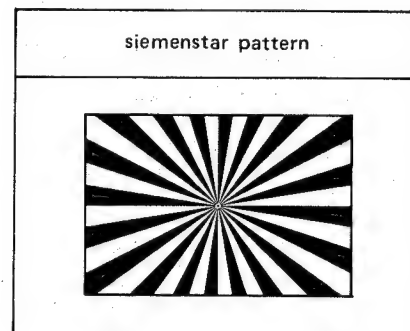


Bottom (shassis)

2.2. CIRCUIT ADJUSTMENTS

Adjustment tools and measuring instruments

- Digital tester
- Oscilloscope
- Monitor
- Siemenstar



* The less the distance to the subject the more the distance between the pickup tube and lens.

• Lens

The lenses cannot be replaced. To change the focal length some optical modification is necessary.

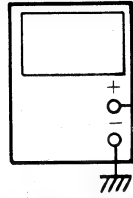
SECTION 3
DIAGRAMS

2-2-1. SR Board Adjustment

4.8V SUPPLY VOLTAGE ADJUSTMENT

1. Connect a digital tester to TP5 in the DF board.
2. Adjust RV3 so that the 4.8V output is within $4.8 \pm 0.04V$.

digital multi-meter



DF Board

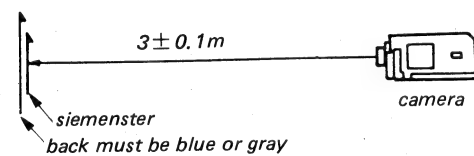
BP-1
Q1 Q2 Q3 Q4RV3
4.8V supply voltage
adjustment

SR Board

2-2-2. PW Board Adjustments

FOCUS ADJUSTMENT

Shoot the subject so that the siemenstar is at the center of the screen and adjust the focus with RV2.

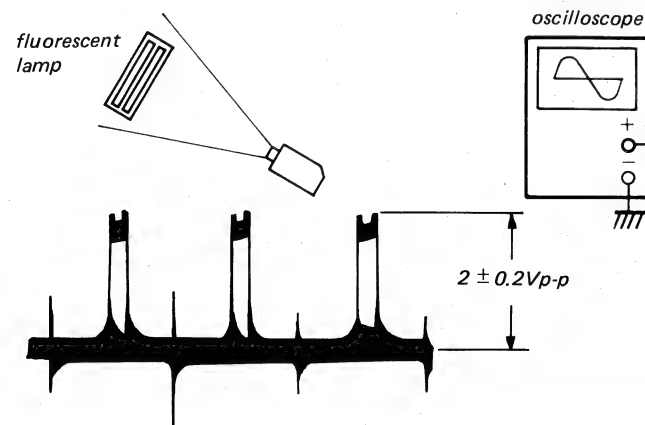
RV2
FocusRV1
Beam adjustment

PW Board

BEAM ADJUSTMENT

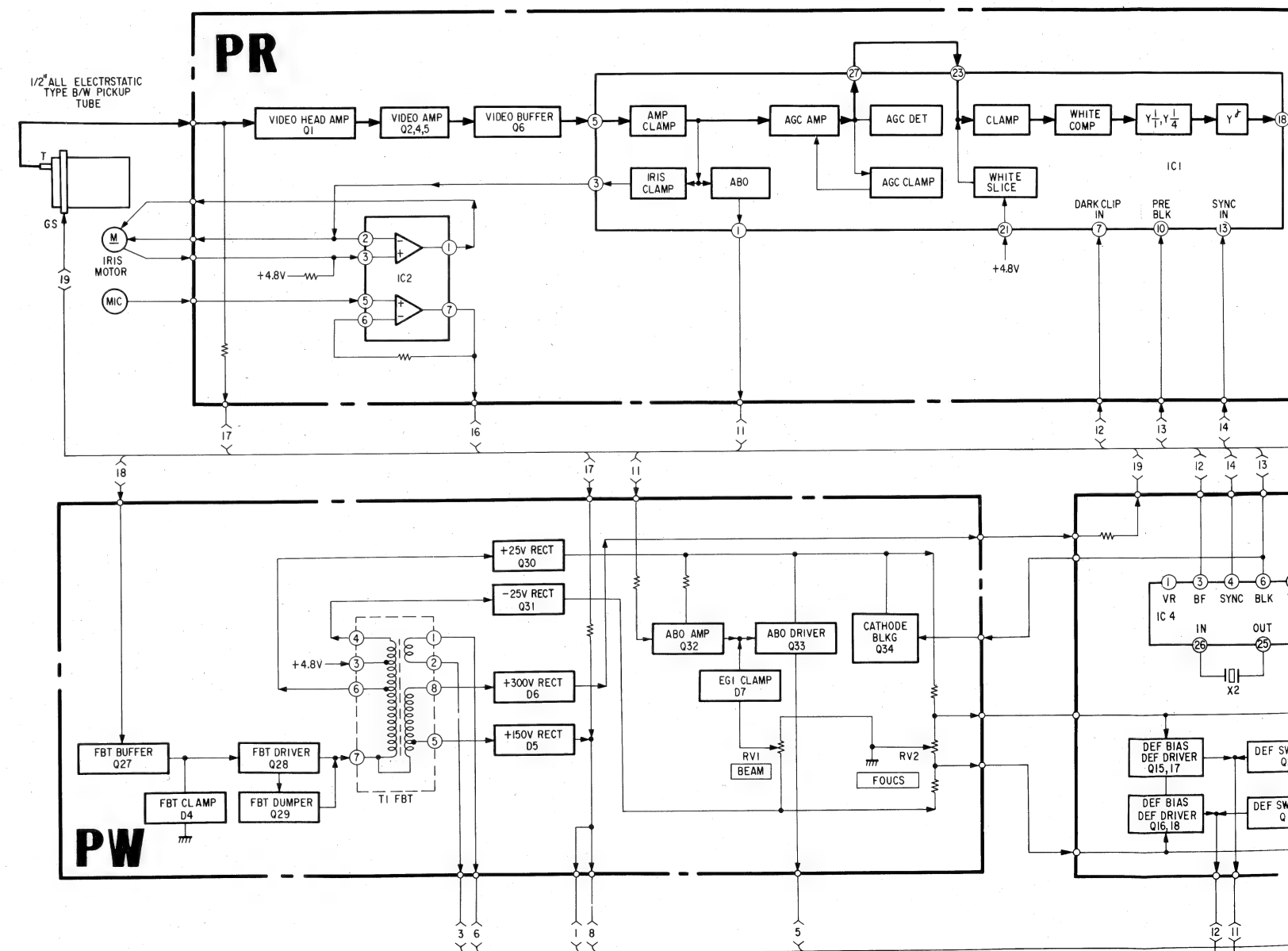
Shoot a fluorescent lamp or something like it and measure the PR card's TP1 with an oscilloscope. Adjust RV1 so that the p-p voltage of the waveform is $2 \pm 0.2V$.

* At this time, move the camera right and left and up and down and check that no beam stop or oscillation occurs. If any oscillation occurs, reduce the beam amount down to 1.5Vp-p. If oscillation still persists, then short the circuit at the R67 short land and adjust RV1.



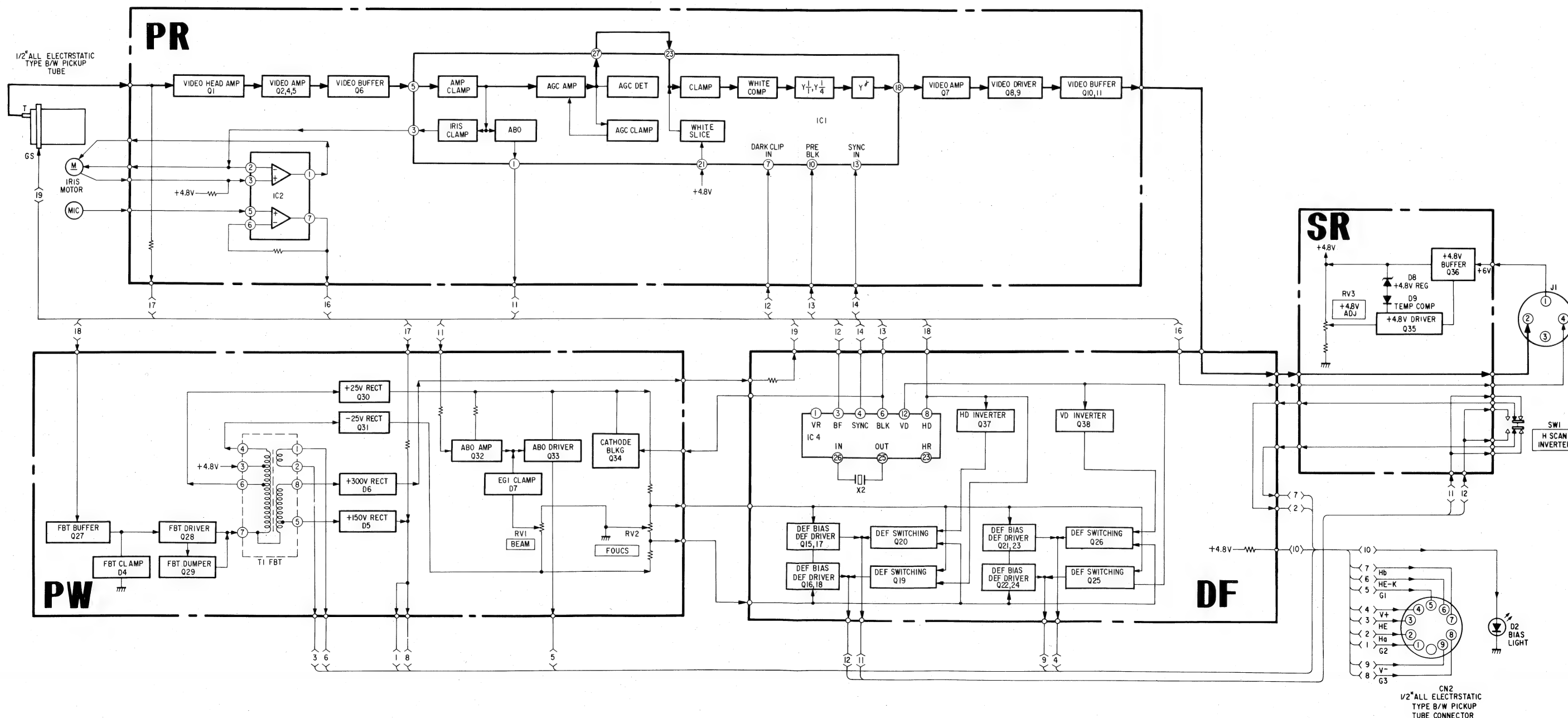
PR Board

3-1. BLOCK DIAGRAM

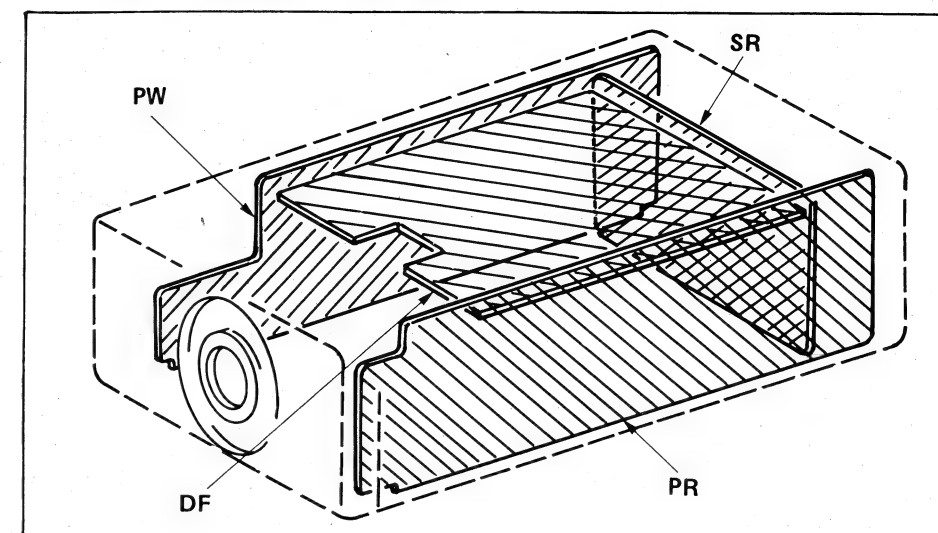


SECTION 3 DIAGRAMS

3-1. BLOCK DIAGRAM








3-2. CIRCUIT BOARDS LOCATION

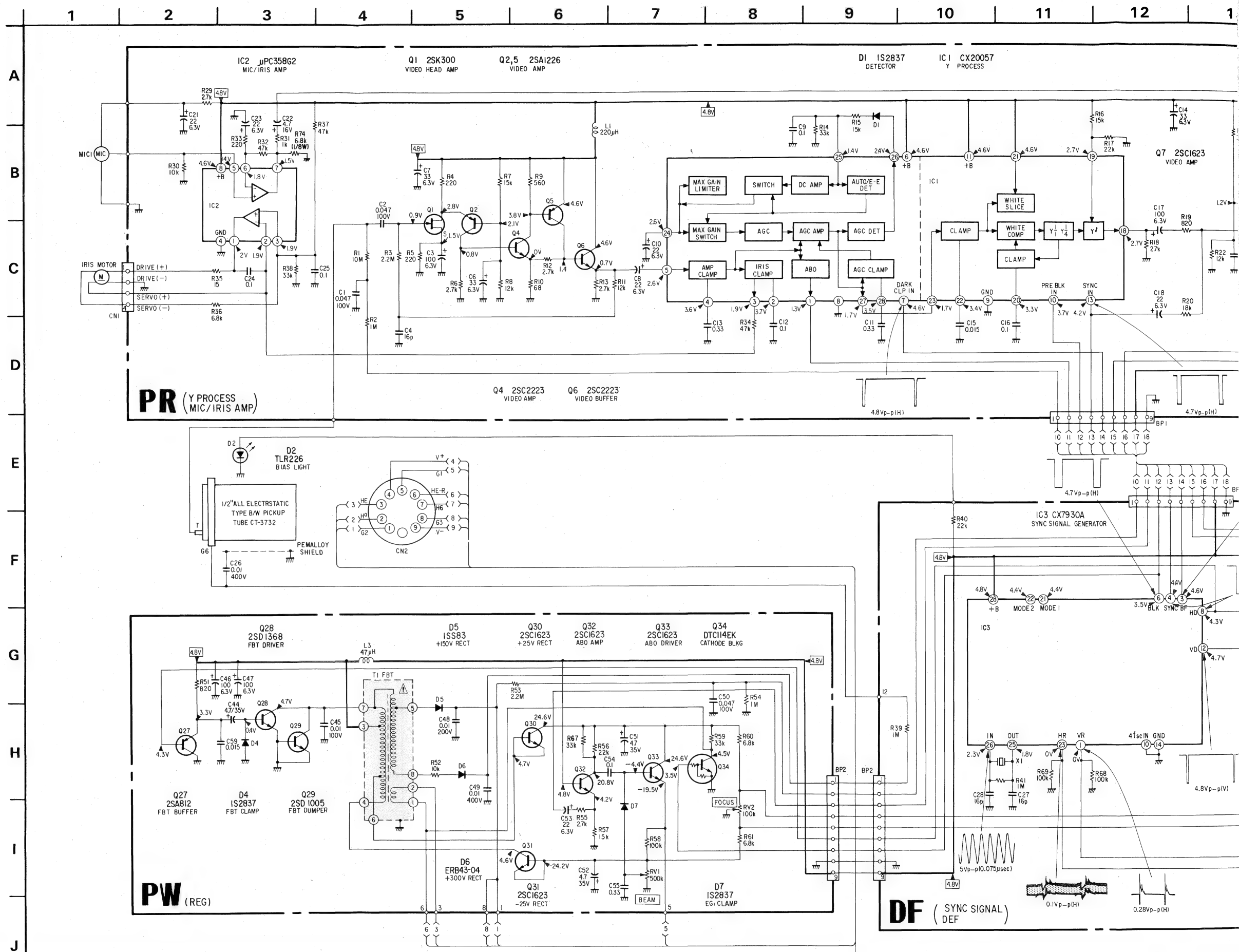


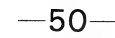
3-3. SCHEMATIC DIAGRAM

Note:

Note: The components identified by shading and mark  are critical for safety. Replace only with part number specified.

- All capacitors are in μF unless otherwise noted. pF : μF 50WV or less are not indicated except for electrolytics
- All resistors are in ohms, $\frac{1}{6}W$ unless otherwise noted. k Ω : 1000 Ω , M Ω : 1000k Ω
-  : nonflammable resistor.
- All variable and adjustable resistors have characteristic curve B, unless otherwise noted.
- \triangle : internal component.
-  : panel designation.
- Voltages are dc with respect to ground unless otherwise noted.
- Readings are taken with a 10M Ω digital multimeter.
-  : adjustment for repair.
- Voltage variations may be noted due to normal production tolerances.
-  : B+ bus.
-  : B- bus.





3-4. PRINTED WIRING BOARDS
— Conductor Side —

[Y PROCESS,
MIC/IRIS AMP]

PR

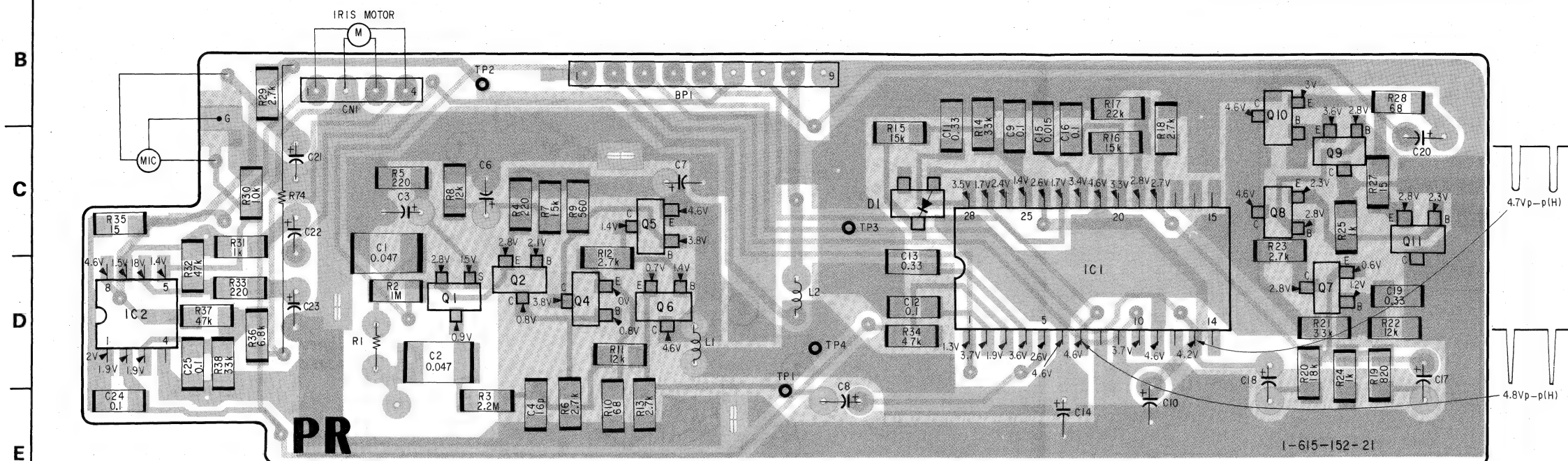
[REG]

PW

PR

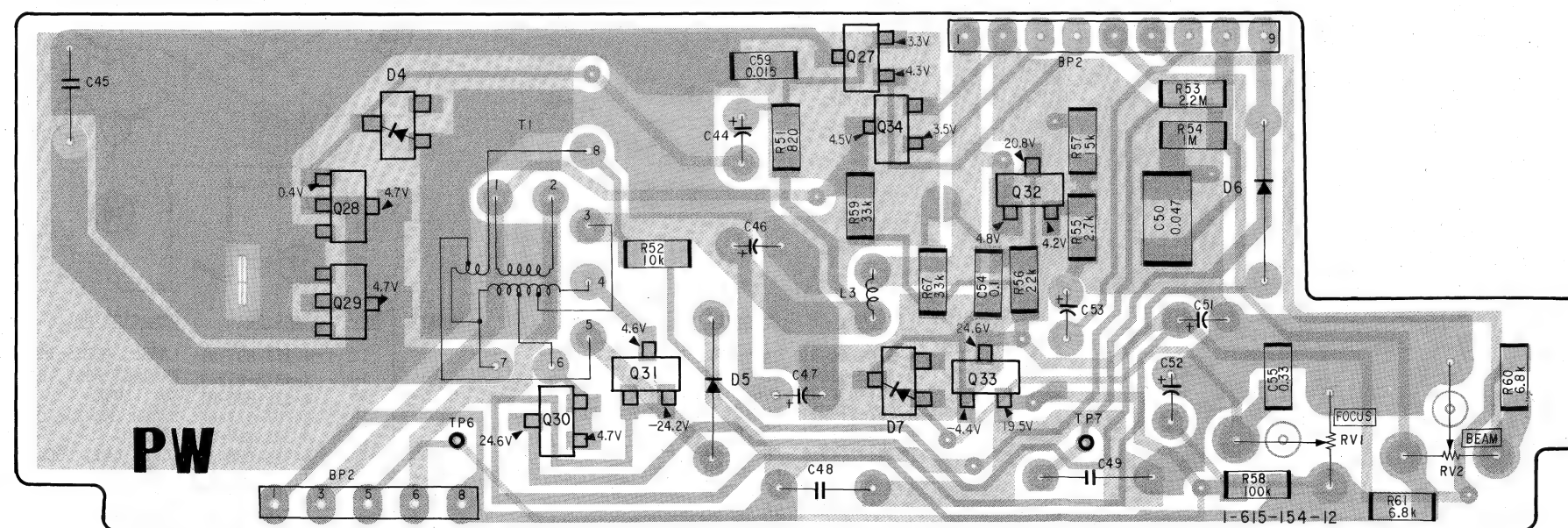
PW

	1	2	3	4	5	6	7	8	9	10	11	12	
	- PR Board -												
A	IC, Q	IC2	1	2	4	5 6				10 8	9 7	11	IC, Q
								1					D
			2				1	4	3				TP

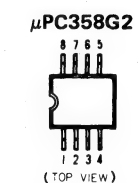
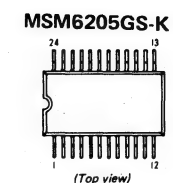
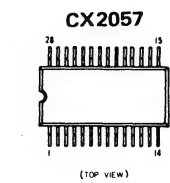


— PW Board —

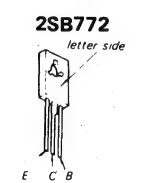
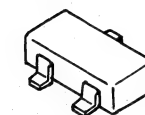
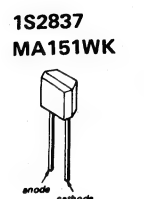
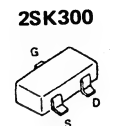
Q	28	29	30	31	27	34	33	32	Q
D	4		5		7		6		D
ADJ							RV1	RV2	ADJ
TP	6				7				TP



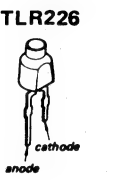
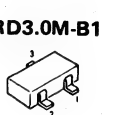
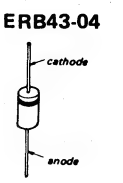
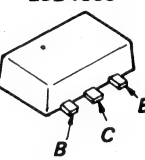
3-5. SEMICONDUCTORS



2SA812
2SA1037K
2SA1162
2SA1179
2SA1226
2SC1623
2SC2223
2SC2412
2SC2712
2SC2714
2SC2812
2SC2813
2SC3052
DTA114EK
DTC114EK



2SD1005
2SD1368



SECTION 4
EXPLODED VIEWS

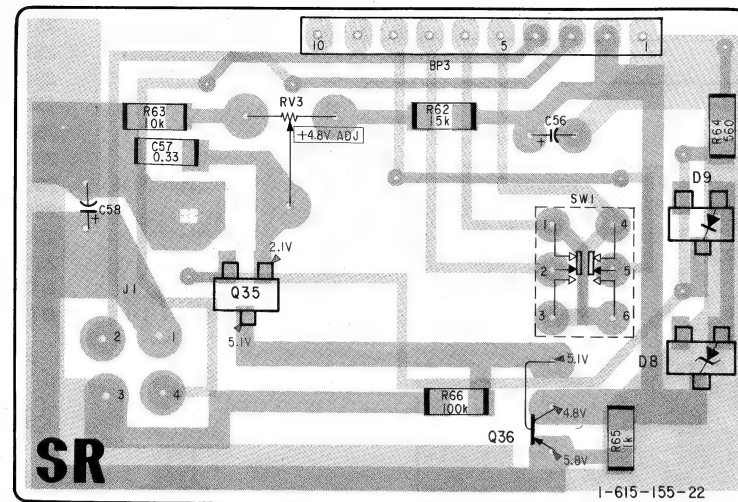
[+4.8V REG]

SR

[NTSC SIGNAL]
DEF

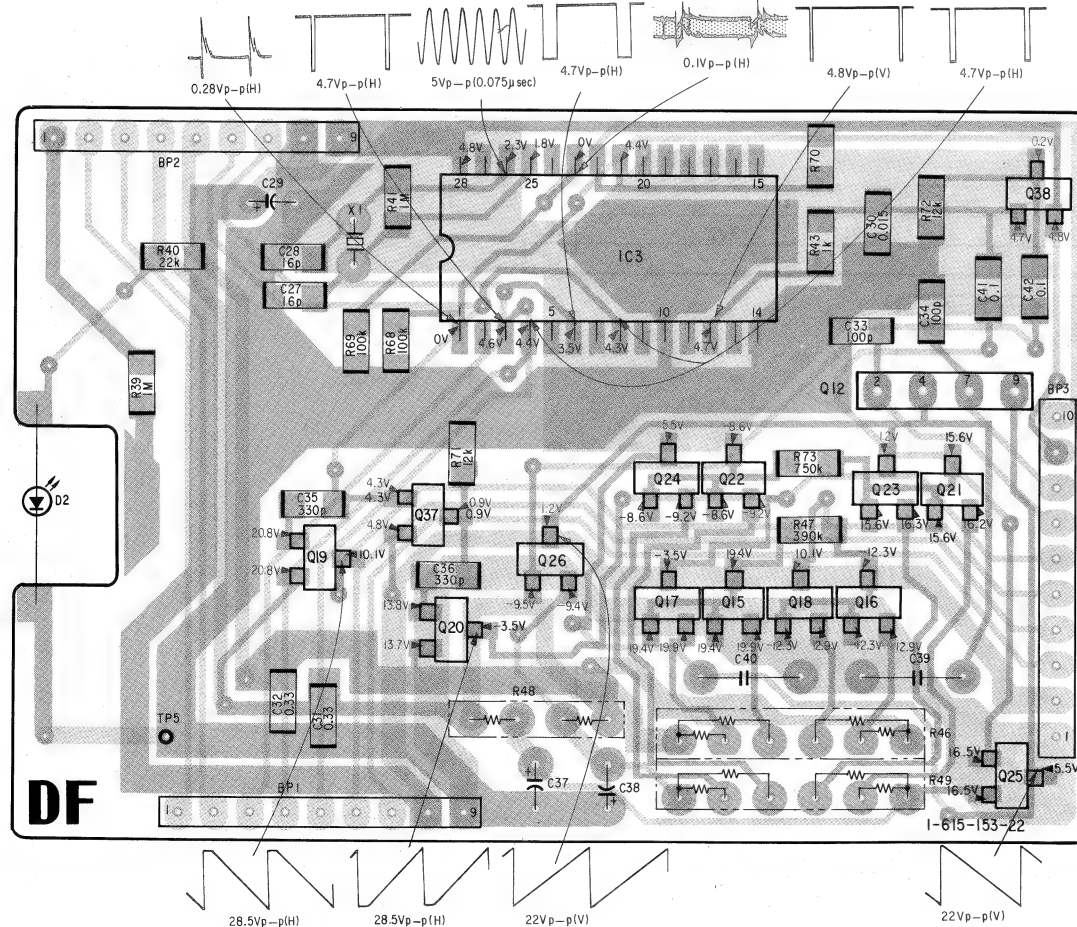
DF

— SR Board —



— DF Board —

IC, Q	TP
38	
IC3	
12	
24,22	23,21
37	
19,26	
17,15,18,16	20
5	
25	
IC, Q	TP



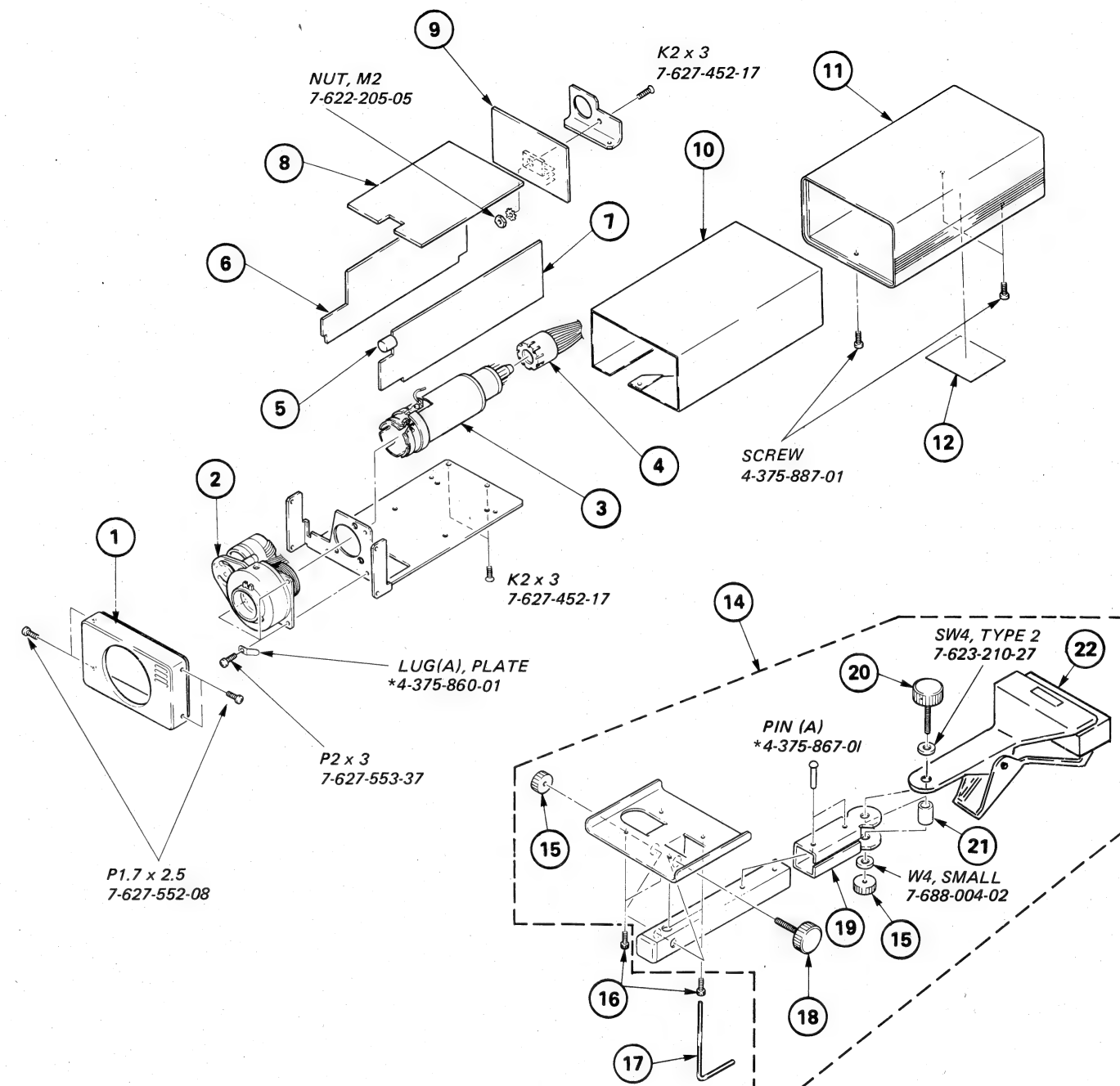
NOTE:

- Items with no part number and no description are not stocked because they are seldom required for routine service.
- The construction parts of an assembled part are indicated with a collation number in the remark column.

- Items marked " * " are not stocked since they are seldom required for routine service. Some delay should be anticipated when ordering these items.

The components identified by shading and mark Δ are critical for safety. Replace only with part number specified.

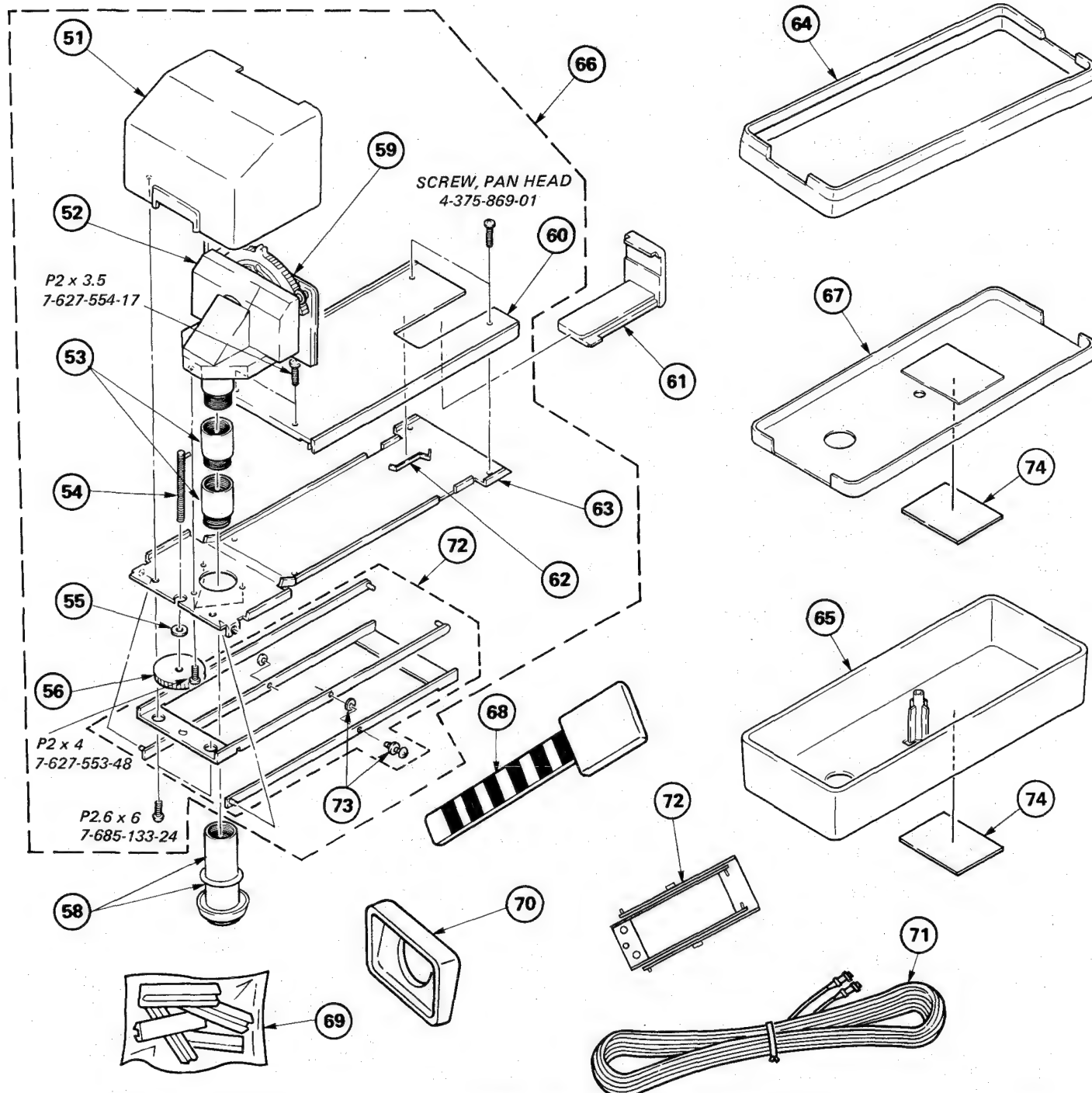
4-1. CAMERA AND CAMERA BRACKET



No.	Part No.	Description
1	4-375-844-01	CASE, FRONT
2	A-7613-058-A	LENS BLOCK ASSY
3	8-701-037-39	TUBE, IMAGE PICKUP CT-3732
4	1-562-919-11	SOCKET ASSY, IMAGE PICKUP TUBE
5	4-375-843-01	COVER, MICROPHONE
6	A-7520-229-A	PW BOARD, COMPLETE
7	A-7520-227-A	PR BOARD, COMPLETE
8	A-7520-228-A	DF BOARD, COMPLETE
9	A-7520-230-A	SR BOARD, COMPLETE
10	*4-375-859-01	SHEET, SHIELD
11	4-375-846-21	CASE, REAR

Remark	No.	Part No.	Description	Remark
	12	*4-375-891-01	LABEL, MODEL NUMBER	
	14	X-4375-812-1	BRACKET ASSY, CAMERA	15,18-22
	15	4-375-830-01	NUT, LOCK	
	16	3-701-577-00	SCREW (M2x5), CAP WRENCH, L	
	17	4-375-856-01	SCREW (A), LOCK HOLDER	
	18	4-375-826-01	SCREW (B), LOCK COLLAR, SPACER	
	19	*4-375-823-01	SCREW (A), LOCK HOLDER	
	20	4-375-832-01	SCREW (B), LOCK COLLAR, SPACER	
	21	4-375-834-01	COLLAR, SPACER	
	22	*4-375-872-01	SPACER PLATE	

4.2. DOOR ADAPTOR



No.	Part No.	Description	Remark	No.	Part No.	Description	Remark
51	4-375-835-01	CASE (A), ADAPTOR		64	4-375-840-01	COVER (13), CHASSIS	
52	*1-547-177-11	LENS, RELAY		65	4-375-862-01	SPACER	74
53	4-375-873-01	RING, EXTENSION		66	*A-7613-064-A	LENS ASSY, RELAY	51-56, 59, 60, 61, 62, 63, 72
54	4-375-819-01	SCREW, SLIDE		67	*X-4375-813-1	CHASSIS ASSY, ADAPTOR	74
55	4-375-866-01	WASHER SPACER		68	4-375-870-01	SCALE	
56	4-375-818-01	NUT, ADJUSTMENT		69	X-4375-809-1	HANGER ASSY, CABLE	
58	1-547-178-11	LENS ASSY, DOOR		70	4-375-861-01	HOOD, CAMERA	
59	4-375-874-01	RETAINER, MOUNT		71	1-558-051-11	CORD, CONNECTION 4P	
60	*4-375-841-01	CASE (B), ADAPTOR		72	*X-4375-816-1	BRACKET ASSY, U	73
61	4-375-815-01	HOOK, SLIDE		73	3-701-437-21	WASHER	
62	4-375-817-01	SPRING		74	*4-375-863-01	TAPE (I), DOUBLE STICK	
63	*4-375-836-01	CHASSIS, BASE					

DF PW

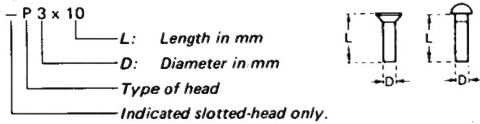
Ref.No.	Part No.	Description	Remark	Ref.No.	Part No.	Description	Remark
	A-7520-228-A	DF BOARD, COMPLETE *****		R47	1-216-530-00	METAL CHIP 390K 1% 1/10W	
	1-567-527-11	VIBRATOR, CRYSTAL		R48	1-235-551-11	NETWORK, RES, THICK FILM	
		CONNECTOR		R49	1-235-552-11	NETWORK, RES, THICK FILM	
BP1	*1-564-551-11	PIN, BOARD TO BOARD (L TYPE)9P		R68	1-216-097-00	METAL CHIP 100K 5% 1/10W	
BP2	*1-564-551-11	PIN, BOARD TO BOARD (L TYPE)9P		R69	1-216-097-00	METAL CHIP 100K 5% 1/10W	
BP4	1-564-549-11	PIN, BOARD TO BOARD(L TYPE)10P		R70	1-216-073-00	METAL CHIP 10K 5% 1/10W	
		CAPACITOR		R71	1-216-075-00	METAL CHIP 12K 5% 1/10W	
C27	1-163-232-00	CERAMIC CHIP 16PF 5% 50V		R72	1-216-075-00	METAL CHIP 12K 5% 1/10W	
C28	1-163-232-00	CERAMIC CHIP 16PF 5% 50V		R73	1-216-543-11	METAL CHIP 1M 1% 1/10W	
C29	1-131-386-00	TANTALUM 33MF 20% 6.3V		*****			
C30	1-163-023-00	CERAMIC CHIP 0.015MF 10% 50V			A-7520-229-A	PW BOARD, COMPLETE *****	
C31	1-162-568-11	CERAMIC CHIP 0.33MF 25V				CAPACITOR	
C32	1-162-568-11	CERAMIC CHIP 0.33MF 25V		C44	1-124-245-00	ELECT 4.7MF 20% 35V	
C33	1-162-569-11	CERAMIC CHIP 100PF 2% 50V		C45	1-136-348-11	FILM 0.01MF 2% 100V	
C34	1-162-569-11	CERAMIC CHIP 100PF 2% 50V		C46	1-124-225-00	ELECT 100MF 20% 6.3V	
C35	1-163-263-00	CERAMIC CHIP 330PF 5% 50V		C47	1-124-225-00	ELECT 100MF 20% 6.3V	
C36	1-163-263-00	CERAMIC CHIP 330PF 5% 50V		C48	1-108-421-00	MYLAR 0.01MF 10% 200V	
C37	1-124-245-00	ELECT 4.7MF 20% 35V		C49	1-136-350-11	FILM 0.01MF 10% 400V	
C38	1-124-245-00	ELECT 4.7MF 20% 35V		C50	1-163-831-00	CERAMIC CHIP 0.047MF 10% 100V	
C39	1-136-349-11	FILM 0.022MF 2% 100V		C51	1-124-245-00	ELECT 4.7MF 20% 35V	
C40	1-136-349-11	FILM 0.022MF 2% 100V		C52	1-124-245-00	ELECT 4.7MF 20% 35V	
C41	1-163-038-00	CERAMIC CHIP 0.1MF 25V		C53	1-124-222-00	ELECT 22MF 20% 6.3V	
C42	1-163-038-00	CERAMIC CHIP 0.1MF 25V		C54	1-163-038-00	CERAMIC CHIP 0.1MF 25V	
		IC		C55	1-162-568-11	CERAMIC CHIP 0.33MF 25V	
IC3	8-757-930-11	IC CX7930A		C59	1-163-023-00	CERAMIC CHIP 0.015MF 10% 50V	
		TRANSISTOR				DIODE	
Q15	8-729-100-76	TRANSISTOR 2SA812		D4	8-719-100-05	DIODE 1S2837	
Q16	8-729-100-66	TRANSISTOR 2SC1623		D5	8-719-901-83	DIODE 1SS83	
Q17	8-729-100-76	TRANSISTOR 2SA812		D6	8-719-903-29	DIODE ERB43-04	
Q18	8-729-100-66	TRANSISTOR 2SC1623		D7	8-719-100-05	DIODE 1S2837	
Q19	8-729-901-04	TRANSISTOR DTA114EK				COIL	
Q20	8-729-900-53	TRANSISTOR DTC114EK		L3	1-407-165-XX	MICRO INDUCTOR 47UH	
Q21	8-729-100-76	TRANSISTOR 2SA812				TRANSISTOR	
Q22	8-729-100-66	TRANSISTOR 2SC1623		Q27	8-729-100-76	TRANSISTOR 2SA812	
Q23	8-729-100-76	TRANSISTOR 2SA812		Q28	8-729-301-25	TRANSISTOR 2SD1368	
Q24	8-729-100-66	TRANSISTOR 2SC1623		Q29	8-729-103-72	TRANSISTOR 2SD1005	
Q25	8-729-901-04	TRANSISTOR DTA114EK		Q30	8-729-100-66	TRANSISTOR 2SC1623	
Q26	8-729-900-53	TRANSISTOR DTC114EK		Q31	8-729-100-66	TRANSISTOR 2SC1623	
Q37	8-729-901-04	TRANSISTOR DTA114EK		Q32	8-729-100-66	TRANSISTOR 2SC1623	
Q38	8-729-901-04	TRANSISTOR DTA114EK		Q33	8-729-100-66	TRANSISTOR 2SC1623	
		RESISTOR		Q34	8-729-900-53	TRANSISTOR DTC114EK	
R39	1-216-121-00	METAL CHIP 1M 5% 1/10W				RESISTOR	
R40	1-216-081-00	METAL CHIP 22K 5% 1/10W		R51	1-216-047-00	METAL CHIP 820 5% 1/10W	
R41	1-216-121-00	METAL CHIP 1M 5% 1/10W		R52	1-216-073-00	METAL CHIP 10K 5% 1/10W	
R43	1-216-049-00	METAL CHIP 1K 5% 1/10W		R53	1-216-129-00	METAL CHIP 2.2M 5% 1/10W	
R46	1-235-552-11	NETWORK, RES, THICK FILM		R54	1-216-121-00	METAL CHIP 1M 5% 1/10W	

NOTE:

—58—

HARDWARE NOMENCLATURE

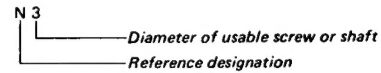
Screw:



Indicated slotted-head only.

Unless otherwise indicated, it means cross-recessed head (Phillips type).

Nut, Washer, Retaining ring:



Reference Designation	Shape	Description	Remarks
SCREWS			
P		pan-head screw	binding-head (B) screw for replacement
PWH		pan-head screw with washer face	binding-head (B) screw and flat washer for replacement
PS PSP		pan-head screw with spring washer	binding-head (B) screw and spring washer for replacement
PSW PSPW		pan-head screw with spring and flat washers	binding-head (B) screw and spring and flat washers for replacement
R		round-head screw	binding-head (B) screw for replacement
K		flat-countersunk-head screw	
RK		oval-countersunk-head screw	
B		binding-head screw	
T		truss-head screw	binding-head (B) screw for replacement
F		flat-fillister-head screw	
RF		fillister-head screw	
BV		brazier-head screw	

Reference Designation	Shape	Description	Remarks
SELF-TAPPING SCREWS			
TA		self-tapping screw	ex: TA, P 3 x 10
PTP		pan-head self-tapping screw	binding-head self-tapping (TA, B) screw for replacement
PTPWH		pan-head self-tapping screw with washer face	binding-head self-tapping (TA, B) screw and flat washer for replacement
PTTWH		pan-head thread-rolling screw with washer face	binding-head (B) screw and flat washer for replacement
SET SCREWS			
SC		set screw	
SC		hexagon-socket set screw	ex: SC 2.6 x 4, hexagon socket
NUT			
N		nut	
WASHERS			
W		flat washer	
SW		spring washer	
LW		internal-tooth lock washer	ex: LW3, internal
LW		external-tooth lock washer	ex: LW3, external
RETAINING RINGS			
E		retaining ring	
G		grip-type retaining ring	